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YITP Annual Report

Yukawa Institute For
Theoretical Physics
Kyoto University

2012

Foreword

We present here an annual report of the scientific activities of Yukawa Institute for Theoretical Physics during the academic year 2012.

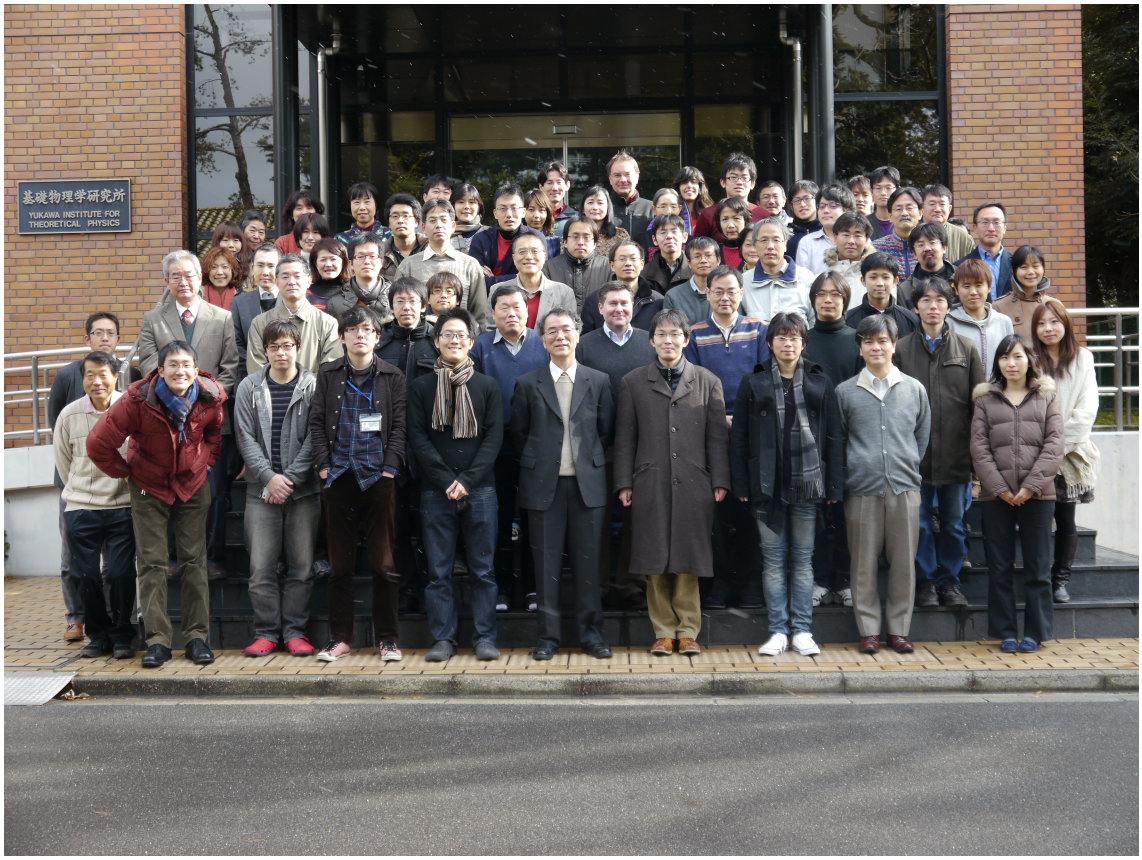
From the year 2007 we started our new project of “Yukawa International program of Quark-Hadron Sciences (YIPQS)" funded by Japan Ministry of Education, Culture, Sports, Science and Technology. In this project we select a few research topics each year for long-term workshops and invite leading experts from abroad to stimulate discussions and foster collaborations among workshop participants. In the year 2012 we held two long-term workshops on "Gauge/gravity duality" and on "Gravity and Cosmology 201", and extensive discussions have been exchanged. Our report contains some of the results obtained during these workshops.

Director
Misao Sasaki

Contents

Chapter 1

People



4 January 2013

1.1 Regular Staff and Guest Professors (2012 April – 2013 March)

Regular Staff

Taichiro Kugo
Professor (E) [– 2013.3.31]

Misao Sasaki
Professor (A)

Hisao Hayakawa
Professor (C)

Takami Tohyama
Professor (C)

Takahiro Tanaka
Professor (A)

Akira Ohnishi
Professor (N)

Masaru Shibata
Professor (A)

Tadashi Takayanagi
Professor (E) [2012.4.1 –]

Ryu Sasaki
Associate Professor (E) [– 2013.3.31]

Masatoshi Murase
Associate Professor (C)

Hiroshi Kunitomo
Associate Professor (E)

Naoki Sasakura
Associate Professor (E)

Keisuke Totsuka
Associate Professor (C)

Shigehiro Nagataki
Associate Professor (A) [– 2013.3.31]

Ken-iti Izawa
Associate Professor (E)

Naoyuki Itagaki
Associate Professor (N)

Fumihiro Takayama
Associate Professor (E)

Kazuo Hosomichi
Associate Professor (E)

Yudai Suwa
Associate Professor (A) [2013.1.1 –]

Daisuke Jido
Assistant Professor (N) [– 2012.12.31]

Seiji Terashima
Assistant Professor (E)

Yu Watanabe
Assistant Professor (C) [2012.8.1 –]

Ippei Danshita
Assistant Professor (C) [2012.10.1 –]

Yuko Fujita
Project Manager

Takayuki Muranushi
Assistant Professor (A)

Takahiro Sagawa
Assistant Professor (C) [– 2012.12.31]

In this list, the symbols A, C, E and N in the parenthesis are the following abbreviations of research fields:

A: Astrophysics and Cosmology
C: Condensed Matter and Statistical Physics
E: Elementary Particle Theory
N: Nuclear Physics Theory

Visiting Professors

Prof. Laurent FREIDEL
(Perimeter Institute for Theoretical Physics)
2012.5.1 — 2012.7.31.
Quantum Gravity

Prof. Jaime GARRIGA
(University of Barcelona)
2012.9.23 — 2012.12.22
Cosmological predeictions from string landscape

Prof. Hans-Josef SCHULZE
(Universita di Catania)
2012.12.2 — 2013.3.1
Nuclear equation of state and hypernuclear physics

Prof. Dirk MANSKE
(Max Planck Institute for Solid State Physics)
2013.1.1 — 2013.3.31
Theoretical study of nonequilibrium dynamics in strongly correlated electron systems

1.2 Research Fellows and Graduate Students (2012 April – 2013 March)

Research Fellows

Takatoshi Ichikawa (N) [2009.4.1 –]
Kenta Kiuchi (A) [2010.2.1 –]
Takashi Hiramatsu (A) [2010.4.1 –]
Yudai Suwa (A) [2010.4.1 – 2012.12.31]
Atsushi Nishizawa (A) [2010.4.1 – 2012.12.31]
Laila Alabidi (A) [2010.11.1 – 2012.10.31]
Yu-ichiro Sekiguchi (A) [2011.1.1 –]
Hiroki Nagakura (A) [2011.4.1 –]
Naoki Yoshioka (C) [2011.4.1 –]
Ryo Saito (A) [2011.4.1 –]
Masashi Kimura (A) [2011.4.1 –]
Kenji Morita (N) [2011.4.1 – 2013.3.31]
Masato Minamitsuji (A) [2011.4.1 – 2013.3.31]
Kazuhiro Sakai (E) [2011.4.1 – 2013.3.31]
Lee Shiu-hang (A) [2011.4.1 – 2013.3.31]
Zhi Li (C) [2011.4.1 – 2013.3.31]
Chul Moon Yoo (A) [2011.4.1 – 2013.3.31]
Lu Hantao (C) [2011.7.1 – 2013.3.31]
Andrea Prudenzia (E) [2011.10.21 –]
Masaomi Ono (A) [2011.11.1 – 2013.3.31]
Hirotaka Ito (A) [2011.11.1 – 2013.3.31]
Ryosuke Yoshii (C) [2012.4.1 –]
Yuichi Takamizu (A) [2012.4.1 –]
Hirotaka Irie (E) [2012.4.1 –]
Naoki Yamamoto (N) [2012.4.1 –]
Hirotada Okawa (A) [2012.4.1 – 2012.7.31]
Kazuya Yonekura (E) [2012.4.1 – 2012.8.31]
Keiju Murata (A) [2012.4.1 – 2013.3.31]
Satoshi Nakamura (N) [2012.5.1 –]
Mao Jirong (A) [2012.7.3 – 2013.3.31]
Norihiro Iizuka (E) [2012.9.1 –]
Hajime Sotani (N) [2012.11.1 –]
Hiroyuki Nakano (A) [2012.11.1 –]
Tolstov Alexey (A) [2013.1.14 – 2013.3.31]

Graduate Students

Koji Azuma (E) [2009.4.1 –]
Masahiro Ikeda (C) [2009.4.1 –]
Kouki Ishimoto (C) [2009.4.1 –]
Koki Nakata (C) [2009.4.1 –]
Soichiro Isoyama (A) [2009.4.1 –]
Yusuke Korai (A) [2009.4.1 –]
Kazuyuki Sugimura (A) [2009.4.1 –]
Kazuhiko Kamikado (N) [2008.4.1 –]
Manabu Sakai (E) [2008.4.1 –]
Kazuya Misao (A) [2008.4.1 –]
Sugure Tanzawa (A) [2005.4.1 –]
Hiroyuki Yoshidsumi (C) [2006.4.1 –]
Moto Araki (C) [2010.4.1 –]
Takashi Nakano (N) [2010.4.1 –]
Tsubasa Takahashi (E) [2010.4.1 –]
Tomotsugu Takahashi (A) [2010.4.1 –]
Masahiro Nozaki (E) [2010.4.1 –]
Naofumi Hama (E) [2010.4.1 –]
Hirotsugu Mitsui (E) [2010.4.1 –]
Kiyoshi Kanazawa (C) [2010.4.1 –]
Koudai Sugimoto (C) [2010.4.1 –]
Zhang Yingli (A) [2010.10.1 –]
Ryo Murakami (C) [2011.4.1 –]
White Jonathan (A) [2011.4.1 –]
Kazuya Shinjo (C) [2011.4.1 –]
Yasunori Matsui (C) [2011.4.1 –]
Tomohiko Sano (C) [2011.4.1 –]
Satoshi Takada (C) [2011.4.1 –]
Takumi Imai (E) [2011.4.1 –]
Tomoki Nosaka (E) [2011.4.1 –]
Noritoshi Hashiba (E) [2011.4.1 –]
Yusuke Kimura (E) [2011.10.1 –]
Hiroshi Ueda (N) [2012.4.1 –]
Terukazu Ichihara (N) [2012.4.1 –]
Kyohei Kawaguchi (A) [2012.4.1 –]

Tokiro Numasawa (E) [2012.4.1 –]

Yasuho Yamashita (A) [2012.4.1 –]

Yuta Yoshida (N) [2012.4.1 –]

Kota Watanabe (C) [2012.4.1 –]

Yuri Ichioka (C) [2012.4.1 –]

Kazuhiko Tanimoto (C) [2012.4.1 –]

Ph.D Awarded

Moto Araki
Steplike electric conduction in a classical two-dimensional electron system through a narrow constriction in a microchannel (C)
(supervisor: Hisao Hayakawa)

Kazuhiko Kamikado
Chiral phase transition in QCD with critical fluctuations (N)
(supervisor: Akira Ohnishi)

Takashi Nakano
Strong-coupling Analysis of Lattice QCD (N)
(supervisor: Akira Ohnishi)

Chapter 2

Research Activities

2.1 Research Summary

Astrophysics and Cosmology Group

Inflation and Early Universe

M. Sasaki with N. Deruelle, Y. Sendouda and A. Youssef considered a theory of Einstein gravity with a Weyl term, but which contains no ghost degree of freedom by invoking local Lorentz symmetry breaking. Applying this theory to the inflationary universe, they found that the amplitude of the tensor perturbation spectrum blows up when the Lorentz-violating scale becomes comparable to the Hubble radius, in sharp contrast to what happens in standard Weyl gravity where the gravitational ghosts smoothly damp out the spectrum of primordial gravitational waves.

J. White, M. Minamitsuji and M. Sasaki considered a multi-field model of inflation in which generally all fields are non-minimally coupled to the Ricci scalar and have non-canonical kinetic terms, and compared the curvature perturbations in the Jordan and Einstein frames. They confirmed that they are indeed not the same, implying that the notion of adiabaticity is not invariant under conformal transformations, though they coincide with each other when the adiabatic limit is reached. They argued that the non-equivalence of the two curvature perturbations would also be important when considering the addition of Standard Model matter into the system.

S. Pi and M. Sasaki studied the quantum fluctuations in a two-component inflaton model with a turning trajectory in the field space by a direct, perturbative, first-principle field theoretical approach. The spectrum of curvature perturbation was computed analytically and the result was found to be consistent with the one obtained previously by an effective field theory approach.

J. Garriga and M. Sasaki with S. Kanno, J. Soda and A. Vilenkin studied pair production in a constant electric field and its Lorentz invariance, by introducing a model detector consisting of other particles interacting with the pairs. Although the in-vacuum state was found to be Lorentz invariant, it was shown that all Lorentzian observers will see the particles and anti-particles nucleating preferentially at rest in the detector's rest frame. Similar conclusions are expected to apply to bubble nucleation in a sufficiently long lived vacuum.

M. Sasaki with F. Arroja computed analytically the dominant contribution to the tree-level bispectrum in the Starobinsky model of inflation. They showed that on small scales the non-linearity parameter oscillates with a characteristic angular frequency determined by the model parameter and its amplitude grows linearly towards smaller scales, which can become large enough to be detected.

M. Sasaki with M. H. Namjoo and H. Firouzjahi found an interesting model of single-field inflation in which the standard non-Gaussianity consistency condition is violated. In this model the curvature perturbations on super-horizon scales are not conserved and the decaying modes of perturbations are not negligible. As a result a large local non-Gaussianity which violates the standard single-field non-Gaussianity consistency condition can be obtained.

Y. Takamizu and M. Sasaki with A. Naruko formulated nonlinear super horizon curvature perturbations in multi-field inflation to second order in spatial gradient expansion, that is, beyond the δN formalism, and found that a large non-Gaussianity can be generated even on super horizon scales, applying it to a specific model. Y. Takamizu with T. Kobayashi also formulated nonlinear super horizon curvature perturbation in a generic single-field inflation with a general non-canonical kinetic terms, to the same order and derived a simple master equation governing the large scale evolution of the nonlinear curvature perturbation.

K. Sugimura and M. Sasaki with D. Yamauchi pointed out a possible generation mechanism of non-Gaussian bubbles in the sky due to bubble nucleation in the early universe. In an inflationary scenario with a curvaton coupled with a tunneling field, the curvaton acquires a space-time dependent non-Gaussian fluctuation due to the nucleation of vacuum bubbles. In this model, they computed the skewness of the curvaton fluctuations and found that the resulting skewness in the statistical distribution of the CMB temperature fluctuations can be indeed large in a localized, spherical region of the sky corresponding to the position of the bubble.

The primordial perturbation is widely accepted to be generated through the vacuum fluctuation of the scalar field which drives inflation. It is, however, not completely clear what is the natural vacuum in the inflationary universe particularly in the presence of non-linear interactions. Focusing on the condition required for the removal of the divergence from the infrared (IR) contribution to loop diagrams, T. Tanaka with Y. Urakawa showed that requesting the gauge invariance/the IR regularity leads to non-trivial constraints on the allowed quantum states. They further proved that choosing the Euclidean vacuum ensures the required gauge invariance and hence the IR regularity of loop corrections.

Related to the above work, Y. Korai and T. Tanaka studied the correlators for an interacting scalar field in the flat chart of de Sitter space to all orders in perturbation. The correlators calculated in the in-in formalism were shown to be identical to the correlators calculated based on the

Euclidean field theory. This correspondence had been already shown graph by graph but they gave an alternative proof of it by direct calculation.

Gravitational Waves

L. Alabidi and M. Sasaki with K. Kohri and Y. Sendouda computed the gravitational wave spectrum generated from the second order terms of the curvature perturbation, and found that it may be enhanced substantially on small scales and may be detected by future space-based gravitational wave detectors such as BBO and DECIGO, while satisfying the bound on the abundance of primordial black holes.

T. Hiramatsu with K. Saikawa, M. Kawasaki and T. Sekiguchi investigated the cosmological constraints on axion models where the domain wall number $N_{\rm DW}$ is greater than one. In these models, multiple domain walls attached to strings are formed, and they survive for a long time. They performed three-dimensional lattice simulations and computed the spectra of axions and gravitational waves produced by long-lived domain walls. They found that the existence of long-lived domain walls leads to the overproduction of cold dark matter axions, while the density of gravitational waves is too small to observe at the present time. As a result, the whole parameter region of models are excluded unless an unacceptable fine-tuning exists.

The final phase of compact binary systems composed of neutron star (NS) and/or black hole (BH) is among the most promising sources for kilo-meter-size laser-interferometric gravitational-wave detectors such as advanced LIGO and KAGRA. The merger of NS-NS or BH-NS binaries is also a likely progenitor of the central engine of short GRBs and a strong emitted of transient electromagnetic signals. K. Kiuchi, Y. Sekiguchi, and M. Shibata with K. Hotokezaka and K. Kyutoku performed a variety of numerical simulations for NS-NS and BH-NS binaries in the framework of numerical relativity. This year, they focused in particular on the mass ejection that efficiently occurs in the merger of NS-NS binaries. They showed that the total ejected mass and kinetic energy of the ejecta depend strongly on the equation of state of the neutron stars. Nevertheless, the typical mass and kinetic energy of the ejecta are $\sim 10^{-2} - -10^{-3} M_\odot$ and $\sim 10^{50}$ ergs/s, which could generate strong transient electromagnetic signals that will be observable by near-future telescopes such as LSST. M. Shibata and K. Kyutoku with K. Hotokezaka also explored the tidal effects of NS-NS binaries in the late inspiral phase and showed that the orbital motion and gravitational waves can be modelled by the effective-one-body approach.

For BH-NS binaries, K. Kyutoku and M. Shibata with his collaborators performed numerical simulations for a variety of equations of state with spinning BHs and then analyzed gravitational waveforms obtained using the method of data analyses. They found that gravitational waves in the late inspiral and merger phases of BH-NS binaries could carry information of NS equation of state, and showed that the equation of state will be able to be constrained by future gravitational-wave observations.

To perform an astrophysically accurate simulation in general relativity, Y. Sekiguchi, K. Kiuchi, and M. Shibata developed new numerical relativity codes. One is a new neutrino-radiation transport code in which not only the cooling but also the heating effects are taken into account in general relativistic manner. Y. Sekiguchi tested this code by performing stellar core collapse of massive stars and confirmed its reliability. The other is a general relativistic magnetohydrodynamics (MHD) code in which a fixed mesh refinement algorithm is incorporated. The MHD code was also efficiently parallelized by K. Kiuchi for the use of K-computer.

S. Isoyama with E. Poisson investigated the dependence of the internal structure of a massive body on the scalar and electromagnetic self-force acting on a static charged particle held at the radius r outside the body. The massive body was assumed to be given by a spherical ball of the polytropic perfect fluid in hydrostatic equilibrium. After expanding the self-force in powers of $1/r$, they found that the leading term of the self-force scales as $1/r^3$ and depends only on the square of the charge and the body's mass. This implies that the leading self-force is universal. At the same time, the next order $\propto 1/r^5$ depends on the structure that reflects the equation of state of the massive body. In particular, for a fixed mass and radius, the next order term of the self-force is smaller when the body is more concentrated.

S. Isoyama and T. Tanaka with R. Fujita, N. Sago and H. Tagoshi also estimated the order of magnitude of the de-phasing of the emitted gravitational waves from a small body in a quasi-circular orbit around a more massive Kerr black hole, focusing on the dissipative part of the second order self-forces. Their result indicates that the de-phasing due to the second order self-forces will be well captured by the 3PN energy flux, once we obtain all the spin dependent terms. As the 3PN energy flux is already known for non-spinning case, this result implies that we might be able to prepare sufficiently accurate templates for extreme or intermediate mass ratio inspirals without full computation of the second order self-forces in the circular orbit case.

S. Isoyama, H. Nakano and T. Tanaka with R. Fujita and N. Sago examined the resonant inspiral of a scalar charged particle around a Kerr black hole in the adiabatic regime, taking into account the scalar radiation reaction. Here the resonance means that the frequencies of the radial and polar orbital oscillations are in a simple rational ratio. In the adiabatic regime the leading order orbital evolution is simply described by the averaged evolution of the constants of motion, i.e., the energy, azimuthal angular momentum and the Carter constant. They succeeded in deriving a new practical formula for the averaged rate of change of the Carter constant, applicable to the resonance case.

Extended Theory of Gravity

Modification to gravity has been discussed a lot in the cosmological context to explain the accelerating expansion of the current universe. A class of modified gravity theories such as the Dvali-Gabadadze-Porrati (DGP)

model or the Galileon model intrinsically shows the so-called Vainshtein mechanism in which the additional scalar degree-of-freedom of the gravitational interaction, or the fifth force, is screened by the non-linear effect recovering general relativity around massive objects like stars. Nevertheless, it was reported that there is the universal perihelion precession rate due to the remnant of the fifth force in the DGP model. T. Hiramatsu with W. Hu, K. Koyama and F. Schmidt investigated how this mechanism work in a two-body system like the Earth-Moon system, and found the mass-dependent reductions in the universal perihelion precession rate. In spite of universal coupling of the scalar degree-of-freedom to matter, which preserves the microscopic equivalence principle, the motion of macroscopic screened bodies depends on their mass, providing in principle a way to test the Vainshtein mechanism.

Y. Zhang and M. Sasaki discussed the mechanism of screening the cosmologcial constant in nonlocal gravity by discovering the decelerated expansion vacuum solutions, which opens a new window towards the resolution of cosmological constant problem. Furthermore, they found that the screening mechanism also works in the Einstein frame.

Y. Zhang, R. Saito and M. Sasaki studied the Hawking-Moss (HM) instanton in the deRGT nonlinear massive gravity and evaluated the dependence of the tunneling rate on the parameters of the theory. It was found that depending on the values of parameters, the tunneling rate can be either enhanced or suppressed when compared to the case of general relativity (GR). Furthermore, for theory to be healthy, it was found that there is an upper bound on the radius of the instanton, in sharp contrast to GR.

T. Tanaka with K. Yagi, L. C. Stein and N. Yunes, studied isolated and binary neutron stars in dynamical Chern-Simons gravity. This theory modifies the Einstein-Hilbert action through the introduction of a dynamical scalar field coupled to the Pontryagin density. First isolated neutron star solutions were constructed in the slow-rotation expansion to quadratic order in spin. It was found that isolated neutron stars acquire a scalar dipole charge that corrects its spin angular momentum to linear order in spin and corrects its mass and quadrupole moment to quadratic order in spin, as measured by an observer at spatial infinity. Furthermore, solving for the orbital evolution of neutron star binaries in this modified theory, they derived how the evolution of post-Keplerian parameters is modified. The results suggest that pulsar observations are not currently capable of constraining dynamical Chern-Simons gravity, and thus, gravitational-wave observations may be the only path to a stringent constraint of this theory in the imminent future.

High-Energy Astrophysics

Y. Suwa with T. Takiwaki and K. Kotake developed a new numerical code, which solves three-dimensional hydrodynamics with the neutrino radiative transfer, and performed simulations of core-collapse supernovae without any symmetry imposed for the first time in the world. They obtained a weak explosion driven by the neutrino heating process.

Y. Suwa with T. Takiwaki, K. Kotake, T. Fischer, M. Liebendörfer, and K. Sato investigated the impact of the nuclear equation of state, which is one of the important ingredients of core-collapse supernova, on the dynamics using multi-dimensional simulation with axial symmetry. They found that the equation of state that leads to faster contraction of protoneutron stars implies better condition to produce the explosion.

H. Nagakura and Y. Suwa with K. Ioka performed special relativistic hydrodynamic simulations to investigate condition for jet to penetrate the massive Population III star's envelope, which is necessary condition for gamma-ray burst (GRB) generation. They found that their numerical simulations gave reliability to their analytic modeling, which gives the criteria of jet penetrability for various types of stars.

Since the prediction of typical mass scale of first stars decreases, Y. Suwa with D. Nakauchi, T. Sakamoto, K. Kashiyama, and T. Nakamura studied the jet penetrability for less massive Population III stars and found that these stars can produce GRBs. By using empirical relation of local GRBs, they gave a prediction for the spectrum and observability for future facilities.

Among possible candidates of the jet production mechanism, neutrino-pair annihilation is one of the most well-discussed. In this mechanism, copious amount of neutrinos are emitted from neutrino-cooling dominated accretion flow. Y. Suwa found that the infalling material in this flow accelerates neutrinos and the non-thermal components enhance the annihilation rate more than 10 times larger.

S. Nagataki and S. Lee, and their collaborators studied temporal changes of X-ray to TeV gamma-ray emissions from the pulsar-Be-star binary PSR B1259-63/LS 2883 based on three-dimensional smoothed particle hydrodynamic simulations of pulsar wind interaction with Be-disk and wind. They focused on the periastron passage of the binary and calculated the variation of the synchrotron and inverse-Compton emissions using the simulated shock geometry and pressure distribution of the pulsar wind. The characteristic double-peaked X-ray light curve from observations was well reproduced by their simulation under a dense Be-disk condition (base density 10-9 g cm-3). They interpreted the pre- and post-periastron peaks as being due to a significant increase in the conversion efficiency from pulsar spin-down power to the shock-accelerated particle energy at orbital phases when the pulsar crosses the disk before periastron passage, and when the pulsar wind creates a cavity in the disk gas after periastron passage, respectively.

S. Lee and S. Nagataki with their collaborator have developed a generalized model of nonlinear diffusive shock acceleration coupled to an evolving supernova remnant (SNR). To model the efficient production of cosmic rays (CRs) in SNRs with the associated coupling between CR production and SNR dynamics, they have generalized an existing cr-hydro-NEI code to include the following processes: (1) an explicit calculation of the upstream precursor structure including the position-dependent flow speed,

density, temperature, and magnetic field strength; (2) a momentum- and space-dependent CR diffusion coefficient; (3) an explicit calculation of magnetic field amplification; (4) calculation of the maximum CR momentum using the amplified magnetic field; (5) a finite Alfven speed for the particle scattering centers; and (6) the ability to accelerate a superthermal seed population of CRs, as well as the ambient thermal plasma. The high-quality spectra expected from Astro-H. SNR RX J1713.7-3946 was modelled as an example.

S. Nagataki with his collaborators investigated the meaning of non-detection of high-energy neutrinos from gamma-ray bursts (GRBs) at IceCube detector. Recently, the increasingly deep limit on the neutrino emission from GRBs with IceCube observations has reached the level that can place useful constraints on the fireball properties. He presented a revised analytic estimate of the neutrino flux, which is one order of magnitude lower than that obtained by the IceCube Collaboration and is consistent with the current observational bound.

S. Nagataki and his collaborators (Telescope Array (TA) Experiment team) studied the anisotropy of Ultra-High Energy Cosmic Ray (UHECR) events collected by the TA detector in the first 40 months of operation. Following earlier studies, they examined event sets with energy thresholds of 10 EeV, 40 EeV, and 57 EeV. They found that the distributions of the events in right ascension and declination are compatible with an isotropic distribution in all three sets. Compared with previously reported clustering of the UHECR events at small angular scales, no significant clustering was found in the TA data. Also, they found no correlation of the events with E $\geq$ 57 EeV with nearby active galactic nuclei. Further, they examined correlations with the large-scale structure (LSS) of the universe. They found that the two higher-energy sets are compatible with both an isotropic distribution and the hypothesis that UHECR sources follow the matter distribution of the universe (the LSS hypothesis), while the event set with E $\geq$ 10 EeV is compatible with isotropy and is not compatible with the LSS hypothesis at 95% CL unless large deflection angles are assumed.

S. Nagataki and his collaborators showed that high-resolution imaging of the Sunyaev-Zel'dovich (SZ) effect opens new possibilities for testing the presence of various high-energy particle populations in clusters of galaxies. A detailed X-ray analysis of the 'Bullet cluster' (1E 0657-56) with Chandra has revealed the presence of additional X-ray spectral components beyond a simple, single-temperature plasma in its X-ray spectra. X-ray methods alone are insufficient to elucidate the origins of these spectral components. They showed that the morphology and magnitude of the SZ effect at high frequencies are critically dependent upon the mechanism by which the additional X-ray spectra are created.

Protoplanetary Disks

T. Muranushi and his collaborators studied the effect of electric discharge on magnetorotational instability (MRI) in protoplanetary disks. They performed three-dimensional shearing box simulations with various values of plasma beta and electrical breakdown models. They found in three-dimensional simulations that the MRI-induced discharge can keep the ionization degree high enough for the MRI to remain active, leading to self-sustainment of MRI in the high resistivity environment. They found that the condition for this self-sustained MRI is set by the balance between the energy supply from the shearing motion and the energy consumed by ohmic dissipation.

T. Muranushi has also developed programming language Paraiso. In Paraiso, one can describe partial differential equation (PDE)-solving algorithms succinctly using tensor equations notation. Hydrodynamic properties, interpolation methods and other building blocks are described in abstract, modular, re-usable and combinable forms. T. Muranushi demonstrated, using Paraiso, automated generation of Navier-Stokes equations solver for both multi-core and GPGPU architectures. He also demonstrated more than 10 times improvement in performance via evolutionary computing-based automated tuning.

Condensed Matter and Statistical Dynamics Group

Condensed-Matter Physics

The subjects of condensed-matter physics are the states of matter that emerge at low-temperatures as a consequence of non-trivial many-body effects. The main goal in this field is to understand how interplay among such low-energy degrees of freedom as charge, spin and (electron) orbital, when combined with a few simple fundamental principles (e.g. Fermi statistics, electromagnetic force), leads to a variety of phenomena. The area of current research in our group includes dynamical properties of strongly-correlated electron systems, physics of the iron-based- and the cuprate superconductors, exotic phenomena in low-dimensional quantum magnetism, and physics of ultra-cold atoms.

Jamming Transition

Otsuki and Hayakawa have numerically studied the jamming transitions. One of their achievements is to summarize the critical scaling of the jamming transition for sheared granular particles based on their extensive simulation. Their other achievement is to find the ambiguity of the jamming point after a quench of a Hamilton system. They also numerically found one of the scaling exponents in this system is a little away from the prediction of replica theory.

Stochastic Energetics for Non-Gaussian Processes

K. Kanazawa, T. Sagawa and H. Hayakawa proposed the new mathematical method to describe the stochastic energetics for non-Gaussian processes. By introducing their new stochastic integral, they investigate the energetics of classical stochastic systems driven by non-Gaussian white noises. In particular, they introduce a decomposition of the total energy difference into the work and the heat for each trajectory, and derive a formula to calculate the heat from experimental data on the dynamics. They apply their formulation and results to a Langevin system driven by a Poisson noise. They also obtained the results for non-standared heat conduction in a system connecting with non-Gaussian noises.

Electric conduction through a narrow constriction in a microchannel

Using molecular dynamics simulations, M. Araki and H. Hayakawa investigated transport properties of a classical two-dimensional electron system confined in a microchannel with a narrow constriction. As a function of the confinement strength of the constriction, the calculated conductance in the simulations exhibits steplike increases. It is confirmed that the number of the steps corresponds to the number of stream lines of electrons through the constriction. They verify that density fluctuation plays a major role in smoothing the steps in the conductance.

Simiation of an oppositely driven binary particle mixture

Using extensive particle-based simulations, M. Ikeda, H. Wada and H. Hayakawa investigated out-of-equilibrium pattern dynamics in an oppositely driven binary particle system in two dimensions. A surprisingly rich dynamical behavior including lane formation, jamming, oscillation and turbulence-like dynamics is found. The ratio of two friction coefficients is a key parameter governing the stability of lane formation. When the friction coefficient transverse to the external force direction is sufficiently small, the lane structure becomes unstable, and the system eventually exhibits a dynamical transition into a novel turbulence-like phae.

Simiation of granular jet

T. G. Sano and H. Hayakawa performed three-dimensional simulations of the impact of a granular jet for both frictional and frictionless grains. Small shear stress observed in the experiment is reproduced through their simulation, but the fluid state after the impact is far from a perfect fluid, because the observed viscosity is finite and its value is consistent with the prediction of the kinetic theory.

The restitution coefficient larger than unity in nanocluster collisions

H. Kuninaka and H. Hayakawa numerically investigate the mechanism of rebounds in which the restitution coefficient is larger than unity for head-on collisions between nanoclusters. It is confirmed that the temperature and the entropy of the nanocluters decrease after the super rebounds by our molecular dynamics simulations. It is also found that the initial metastable structure plays a key role for the emergence of the super rebounds.

Geometric adiabatic pumping for nonequilibrium quantum dots

For an open quantum system, T. Yuge, T. Sagawa, A. Sugita and H. Hayakawa investigated the pumped current induced by a slow modulation of control parameters on the basis of the quantum master equation and full counting statistics. They found that the average and the cumulant generating function of the pumped quantity are characterized by the geometrical Berry-phase in the parameter space. From their formulation, they can discuss the geometrical pumping under the control of the chemical potentials and temperatures of reservoirs. They demonstrated that the geometrical pumping is prohibited for the case of noninteracting electrons if we modulate only temperatures and chemical potentials of reservoirs, while the geometrical pumping occurs in the presence of an interaction between electrons for spinless quantum dots.

Fluctuation theorem in information statistical mechanics

T. Sagawa and M. Ueda established the fluctuation theorem in the presence of information exchange between a nonequilibrium system and other degrees of freedom such as an observer and a feedback controller, where the amount of information exchange is added to the entropy

production. The resulting generalized second law sets the fundamental limit of energy dissipation and energy cost during the information exchange. Their results apply not only to feedback-controlled processes but also to a much broader class of information exchanges, and provide a unified framework of nonequilibrium thermodynamics of measurement and feedback control.

Time-dependent Ginzburg Landau equation for sheared granular flow:

K. Satioh and H. Hayakawa examined the validity of the time-dependent Ginzburg-Landau equation of granular fluids for a plane shear flow under the Lees-Edwards boundary condition derived from a weakly nonlinear analysis through the comparison with the result of discrete element method. They verify quantitative agreements in the time evolutions of the area fraction and the velocity fields, and also find qualitative agreement in the granular temperature.

Nonequilibrium mode-coupling theory for uniformly sheared underdamped systems:

Nonequilibrium mode-coupling theory (MCT) for uniformly sheared underdamped systems is developed, starting from the microscopic thermostated Sllod equation and the corresponding Liouville equation. The derived MCT equation satisfies the alignment of the wave vectors and is manifestly translationally invariant. Isothermal condition is implemented by the introduction of current fluctuation in the dissipative coupling to the thermostat. This current fluctuation grows in the relaxation regime, which generates a pronounced relaxation of the yield stress compared to the overdamped case. This result fills the gap between the molecular dynamics simulation and the overdamped MCT reported previously. The response to a perturbation of the shear rate demonstrates an inertia effect which is not observed in the overdamped case.

Living systems and cognitive functions

What is cognition? Cognition is such a common experience that we rarely try to define it in our everyday life. Yet no one who has worked on this problem has ever been able to answer it in a satisfactory way. This is probably not because we lack complete knowledge of components such as molecules, neurons or neural networks at different hierarchical levels of a human being, but because we lack a 'constructive' view integrating the fragments of knowledge at different levels during our investigation of the history of life. Actually, it is traditionally assumed that there is a very clear distinction between thinking subject and observed object. However, when we try to understand our cognitive process, it certainly appears to be a serious problem that there is no clear distinction between subject and object; we are both spectators and actors in the world. The only way to understand the problem 'what is cognition?' is, therefore, to construct a new framework involving both thinking subjects and observed objects. It is a 'self-nonself circulation' process proposed by M. Murase that would operate during not only a developmental history of an individual human, but also an evolutionary history of life itself, as both are undoubtedly conducted by continuous actions of life in the world and simultaneously unavoidable reactions from it. The present paper further involves an idea that both evolution (or development or even the onset of disease) and cognition must fit the same principle of self-nonself circulation, and then develops a theory of 'constructive cognition'.

Formulation of Heisenberg's uncertainty relation by using quantum estimation theory

Heisenberg's uncertainty relation is one of the fundamental problem on quantum theory. Y. Watanabe investigated that the error in the quantum measurement and the disturbance caused by the back-action of the measurement are caracterized by the Fisher information, which is one of the important value in statistics and characterizes the accuracy of the estimation. Y. Watanabe showed that the trade-off relation between the error and disturbance which gives a stronger bound than the well known bound set by the commutation relation.

First-principles calculation of helical spin order in iron perovskite $SrFeO_3$ and $BaFeO_3$: Motivated by the recent discovery of ferromagnetism in cubic perovskite $BaFeO_3$ under small magnetic field, Li, Tohyama, and their collaborators investigated spin order in $BaFeO_3$ and isostructural $SrFeO_3$ by first-principles calculation. On-site Coulomb and exchange interactions are necessary for the helical spin order consistent with experiments. $SrFeO_3$ exhibits stable G-type helical order, while A- and G-type helical orders in $BaFeO_3$ are almost degenerate at a short propagating vector with a tiny energetic barrier with respect to ferromagnetic spin order, explaining ferromagnetism under a small field. The spin order under high pressure was also studied. At ambient pressure, A-type and G-type helical spin orders are almost degenerate in $BaFeO_3$. When the lattice constant is reduced, G-type helical spin order becomes stable. Phase transition from helical spin state to ferromagnetic state in both $SrFeO_3$ and $BaFeO_3$ takes place if the lattice constant is further reduced. The results agree with recent experimental result of $BaFeO_3$ under high pressure.

Enhanced charge order in a photoexcited one-dimensional strongly correlated system: One of the outstanding contemporary challenges in condensed matter physics is to understand the dynamics of interacting quantum systems exposed to an external perturbation. Lu, Tohyama, and their collaborators presented a compelling response of a low-dimensional strongly correlated system to an external perturbation. Using the time-dependent Lanczos method, they investigated a nonequilibrium evolution of the half-filled one-dimensional extended Hubbard model, driven by a transient laser pulse. When the system is close to the phase boundary, by tuning the laser frequency and strength, a sustainable charge order enhancement is found that is absent in the Mott insulating phase. They also analyzed the conditions and investigate possible mechanisms of emerging charge order enhancement. Feasible experimental realizations were proposed.

A new type of symmetry-protected topological phases in ultra-cold alkaline-earth fermions in one dimen-

sion: In contrast to higher-dimensional situations, only short-range entanglement is possible in one-dimensional gapped systems and this prevents genuine topological orders in one dimension. Nevertheless, we can still define a certain class of topological phases stable *only* in the presence of some symmetries (e.g., time-reversal, parity, SO(3), etc.). This class of topological phases is called symmetry-protected as they can be adiabatically deformed into trivial ones in the absence of the protecting symmetries. Although a fairly complete catalogue of these phases is known, only a few physical systems, that harbor them, have been known so far. Nonne, Moliner, Capponi, Lecheminant, and Totsuka proposed a system of ultra-cold alkaline-earth fermions (e.g. Yb^{171}, Yb^{173}, and Sr^{87}) loaded into a one-dimensional optical lattice as a simple physical system that realizes several topological phases. The hallmarks of this system are SU(N) symmetry (e.g., $N = 6$ for Yb^{173}) that is realized with a very high precision and great tunability. By means of various methods (bosonization, strong-coupling expansions, density-matrix renormalization group, etc.), they mapped out the phase diagram to find a clear dependence of the phase structure on the parity of N. When N is even (this is relevant for Yb^{171}, Yb^{173}, and Sr^{87}), the phase diagram obtained is rich and contains a new symmetry-protected topological phase which is characterized by a certain kind of non-local correlations.

Quantum entanglement and symmetry-protected topological order: Quantum entanglement is now recognized as a useful tool that characterizes properties of many-body wave functions. In particular, topological order is a property of ground-state wave functions and entanglement, which is defined only in terms of ground states, is desirable for the characterization of topological order without relying on the excitations. In the context of symmetry-protected topological order mentioned above, a precise characterization of the 'topological' Haldane phase, which has been traditionally discussed by using a certain type of non-local correlation functions (string order parameters), has been made recently by using the so-called entanglement spectrum. Hasebe and Totsuka investigated a family of solvable models of hole-doped spin systems in one dimension and discussed their entanglement properties and topological order. In particular, they found an intimate connection between the above traditional characterization in terms of the non-local string order parameters and the modern entanglement description.

Semiclassical approach to competing quantum orders in one dimension: The existence of various frustrating interactions may destroy such conventional magnetic long-range orders as Néel antiferromagnetism and even lead to totally featureless topological quantum fluids dubbed quantum spin liquids, which does not exhibit symmetry breaking. Even among symmetry-broken phases, however, we can find various unconventional phases without usual magnetic orders in frustrated systems. The four-spin ring exchange interaction, which is a generalization of the usual two-spin exchange interaction, is believed to be one of the driving force that stabilizes those unconventional phases. Although some numerical results had been known, systematic understanding of the global phase structure had been missing. Totsuka, Lecheminant, and Capponi constructed a systematic semi-classical approach to competing unconventional phases in a two-leg spin ladder with the ring-exchange interaction and mapped out the phase diagram in the absence/presence of magnetic field. The results are in a reasonably good agreement with the results obtained previously by numerical simulations.

Counterflow superfluid with polaron pairs in Bose-Fermi mixtures: Recently, an experimental group at Kyoto University has reported the realization of a novel dual Mott insulator in a system of a Bose-Fermi mixture of Ytterbium isotopes (^{174}Yb-^{173}Yb) in optical lattices. In this phase the total density is pinned to unit filling, while the individual densities are unrestricted and assumed to be less than unity. This suggests that the degree of freedom in the dual Mott insulator can be regarded as a gas of composite fermions (polarons) constituting of a fermion and a bosonic hole. In order to study the transition to and quantum states inside the Mott insulator phase, Danshita, in collaboration with Mathey at Hamburg University, applied both Tomonaga-Luttinger liquid theory and time-evolving block decimation method to the one-dimensional Bose-Fermi-Hubbard model. They found that a counterflow superfluid phase with pairing of polarons occupies a broad range of the parameter space. They showed that this state is expected to be formed in the dual Mott insulator regime of ^{174}Yb-^{173}Yb mixtures in optical lattices at sufficiently low temperatures.

Nuclear Theory Group

The main focus of our research group is the basic investigation of nuclear physics covering all the physical phenomena governed by the strong interactions, such as the structure and the dynamics of nuclei and hadrons, and properties of hadron-quark many-body system in finite temperatures and densities. Here we briefly review our research activity in the academic year of 2012.

Nuclear structure and dynamics

Synthesis of thin, long heavy nuclei in ternary collisions: Itagaki, Iwata, and collaborators illustrated the formation of a thin, long structure of heavy nuclei by three-nucleus simultaneous collisions within time-dependent density functional theory. The impact parameter dependence for such a formation is systematically demonstrated through clarifications of the difference between binary and ternary collision events. A new method for producing thin, long heavy nuclei in the laboratory was suggested, as well as the possible formation of the thin, long structure in hot dense matter such as that encountered in core collapse supernovae.

Investigation of $3/2^-_2$ state of ^{9}Li nucleus with microscopic structure and reaction models: Itagaki, Furumoto, and collaborators have investigated the low-lying states of the ^{9}Li nucleus with a unified framework of microscopic structure and reaction models. In the structure model, the wave function is fully antisymmetrized and the ^{9}Li nucleus is described as an $\alpha + t + n + n$ four-body system, and low-lying $1/2^-$, $3/2^-$, $5/2^-$, and $7/2^-$ states are obtained by the stochastic multi-configuration mixing method. Using these wave functions, the quasi-elastic cross section at E/A = 60 MeV and the elastic and inelastic cross sections at E/A = 50 MeV on the ^{12}C target were calculated in the framework of the microscopic coupled channel (MCC) method. The characteristic inelastic angular distribution is seen in the $3/2^-_2$ state, whose α+t cluster structure and valence neutron configurations are discussed in detail. They found the possibility of triaxial deformation and mixing of di-neutron components in the ^{9}Li nucleus.

Novel and simple description for smooth transition from α cluster to jj-coupling shell model wave function: Itagaki, Suhara, and collaborators proposed an improved version of Antisymmetrized Quasi-Cluster Model (AQCM) to describe a smooth transition from the α-cluster wave function to the jj-coupling shell model wave function and apply it to the ground state of ^{12}C. The cluster-shell transition in ^{12}C is characterized in AQCM by only two parameters: R representing the distance between α clusters and the center of mass, and Λ describing the break of α clusters. The optimal AQCM wave function for the ground state of ^{12}C is an intermediate state between the three-α cluster state and the shell model state with the $p_{3/2}$ subshell closure configuration. The result is consistent with that of the Antisymmetrized Molecular Dynamics (AMD), and the optimal AQCM wave function quantitatively agrees with the AMD one, although the number of degrees of freedom in AQCM is significantly fewer.

Search for three-α states around an ^{16}O core in ^{28}Si: Ichikawa, Itagaki, and collaborators have investigated the existence of weakly coupled gaslike states comprised of three α particles around an ^{16}O core in ^{28}Si. They calculated the excited states in ^{28}Si using the multiconfiguration mixing method based on the ^{16}O+3α cluster model. To identify the gaslike states, they calculated the overlap of the obtained states with the Tohsaki-Horiuchi-Schuck-Ropke (THSR) wave function. The results show that the obtained fourth and twelfth states significantly overlap with the THSR wave function. The calculated isoscalar monopole strengths between those two states are significantly large, indicating that the states are members of the excitation mode. Furthermore, the calculated root-mean-square radii for these states also suggest that a layer of gaslike three α particles could exist around the surface of the ^{16}O core, which can be described as a "two-dimensional gas" in the intermediate state before the Hoyle-like three-α states emerge.

Torus Configuration in High-Spin Excited States of ^{40}Ca: Ichikawa, Itagaki, and collaborators have investigated the possibility of the existence of the exotic torus configuration in the high-spin excited states of ^{40}Ca. To this end, they used a three-dimensional cranked Skyrme Hartree-Fock method and search for stable single-particle configurations. They found one stable state with the torus configuration at the total angular momentum J=60 $\hbar$ and an excitation energy of about 170 MeV in all calculations using various Skyrme interactions. The total angular momentum $J = 60\ \hbar$ consists of aligned 12 nucleons with the orbital angular momenta Λ = +4, +5, and +6 for spin-up or -down neutrons and protons. The obtained results strongly suggest that a macroscopic amount of circulating current breaking the time-reversal symmetry emerges in the high-spin excited state of ^{40}Ca.

Nuclear fusion reaction: Ichikawa and his collaborators investigated when two colliding nuclei approach each other, their quantum vibrations are damped near the touching point. To show this, they for the first time applied the random-phase-approximation (RPA) method to the two-body ^{16}O + ^{16}O and ^{40}Ca + ^{40}Ca systems. They calculated the octupole transition strengths for the two nuclei adiabatically approaching each other. The calculated transition strength drastically decreases near the touching point, strongly suggesting the vanishing of the quantum couplings between the relative motion and the vibrational intrinsic degrees of freedom of each nucleus. They showed that this damping is responsible for the fusion hindrance phenomena measured in the deep sub-barrier fu-

sion reactions.

Splitting of the p orbit in triaxially deformed ${}^{25}_{\Lambda}$Mg: Finding clear evidence of triaxiality is a long standing problem of nuclear physics. ^{24}Mg is considered to be triaxially deformed. Ohnishi in collaboration with Isaka, Kimura and Dote studied the structure of ${}^{25}_{\Lambda}$Mg, and found that three Λ p orbits have different single particle energies due to the triaxial deformation of the core nucleus ^{24}Mg, and Λ-core coupling splits the ground and $K^{\pi} = 2^{+}$ rotational bands of ^{24}Mg. This finding would be a clear signature of the triaxiallity of ^{24}Mg.

Hadron structure and dynamics

η' meson under partial restoration of chiral symmetry: Jido and his collaborators discussed the in-medium modification of the η' mass in the context of partial restoration of chiral symmetry in nuclear medium. They emphasized that the $U_A(1)$ anomaly effects causes the η'-η mass difference necessarily through the chiral symmetry breaking. As a consequence, the η' mass is expected to be reduced by order of 100 MeV in nuclear matter where about 30% reduction of chiral symmetry takes place. The strong attraction relating to the η' mass generation eventually implies that there should be also a strong attractive interaction in the scalar channel of the η'-N two-body system. They found that the attraction can be strong enough to form a bound state.

Quark condensate in nuclear matter based on chiral effective theory: Jido and his collaborator discussed the density corrections of the quark condensate up to a NLO order using the chiral Ward identity and an in-medium chiral perturbation theory. The in-medium chiral condensate was calculated by a correlation function of the axial current and pseudoscalar density in the nuclear matter as a consequence of the chiral Ward identity. The correlation function is evaluated using the chiral perturbation theory with the hadronic quantities of pion-nucleon dynamics. This study showed that the medium effects to the chiral condensate beyond the linear density come from density corrections to the πN sigma term. It implies that calculating the density dependence of the chiral condensate in nuclear matter is essentially equivalent to describe nuclear matter in chiral effective theory.

Extraction of Meson Resonances from Three-pions Photoproduction Reactions: Nakamura in collaboration with Kamano, Lee, and Sato have investigated the model dependence of meson resonance properties extracted from the Dalitz-plot analysis of the three-pions photoproduction reactions on the nucleon. Within a unitary model, they generate Dalitz-plot distributions as data to perform an isobar model fit that is similar to most of the previous analyses of three-pion production reactions. It is found that the resonance positions from the two models agree well when both fit the data accurately, except for the resonance poles near branch points. The residues of the resonant amplitudes extracted from the two models agree well only for the isolated resonances with narrow widths. For overlapping resonances, most of the extracted residues could be drastically different. The results suggest that the resonance extraction should be based on models constrained by three-particle unitarity condition.

Neutrino-induced forward meson-production reactions in nucleon resonance region: As a first step toward developing a reaction model that enables a comprehensive description of neutrino-nucleon reactions in the nucleon resonance region, Nakamura in collaboration with Kamano, Lee, and Sato have applied for the first time a dynamical coupled-channels model, which successfully describes $\pi N, \gamma N \to \pi N, \eta N, \pi\pi N, K\Lambda, K\Sigma$ reactions up to $W = 2$ GeV, to predict the neutrino-induced meson-production reactions with $\Delta S = 0$ at the forward angle limit. This has been achieved by relating the divergence of the axial-current matrix elements at $Q^2 = 0$ to the $\pi N \to X$ reaction amplitudes through the PCAC hypothesis. We present the contributions from each of the $\pi N, \eta N, \pi\pi N, K\Lambda, K\Sigma$ channels to the F_2 structure function at $Q^2 \to 0$ limit up to $W = 2$ GeV.

η' mass at finite temperature: Morita, in collaboration with Kwon, Lee and Wolf, studied change of η' mass at finite temperature by restoration of chiral symmetry. They generalized the Witten-Veneziano formula to finite temperatures. Then, combining it with the behavior of the gluon condensate and a two-point function, they pointed out that the mass of η' will be quenched at finite temperature.

Exotic hadrons and hadron—hadron interaction in heavy-ion collision: Ohnishi, Jido and Morita for the ExHIC collaboration discussed the exotic hadron structure and hadron-hadron interaction in view of heavy-ion collisions. It is demonstrated that a hadronic molecule with a large spatial size would be produced more abundantly in the coalescence model compared with the statistical model result. Finite effects of the source is also discussed; coalescence model seems to favor hadrons whose shape of the internal Wigner function in the phase space is similar to the shape of the source. As another subject, $\Lambda\Lambda$ interaction is also discussed. Recently measured $\Lambda\Lambda$ correlation data can be utilized to constrain $\Lambda\Lambda$ interaction. RHIC-STAR data favor the $\Lambda\Lambda$ interaction with scattering parameters in the range $1/a_0 \leq -0.8$ fm^{-1} and $r_{\rm eff} \geq 3$ fm.

QCD matter and phase diagram

Functional renormalization group study of phonon mode effects on the chiral critical point: The QCD critical point at finite density connects the crossover transitions at low densities and the first order transition at high densities. The soft mode around the critical point should be the quark-number density fluctuation, *i.e.* the phonon mode φ, from hydrodynamics arguments, while the chiral field σ should also show critical behavior. Kamikado, Morita and Ohnishi in collaboration with Kunihiro analyzed the phonon mode effects on the QCD critical point by using the functional renormalization group (FRG) equation. The coupling of σ and φ modes is introduced in a quark-meson model, and the fluctuations of these fields are taken into account by solving the FRG equation. It is found

that mixing of the two dynamical variables causes a kind of level repulsion between the curvature masses, which in turn leads to an expansion of the critical region of the QCD critical point, depending on the coupling constants in the model yet to be determined from microscopic theories or, hopefully, by experiments.

QCD phase diagram with 2-flavor lattice fermion formulations: Ohnishi in collaobration with Misumi and Kimura proposed a new framework for investigating two-flavor lattice QCD with finite temperature and density. In the Karsten-Wilczek fermion formulation, a species-dependent imaginary chemical potential term can reduce the number of species to two without losing chiral symmetry. This lattice discretization is useful for study on finite-(T,μ) QCD since its discrete symmetries are appropriate for the case. To show its applicability, strong-coupling lattice QCD is applied to the QCD phase diagram. The effective potential is obtained as a function of the scalar meson field. The phase boundary of the chiral phase transition is qualitatively consistent with the phenomenologically expected phase diagram.

Auxiliary field Monte-Carlo study of the QCD phase diagram at strong coupling: Ohnishi and Nakano in collaboration with Ichihara investigated the fluctuation effects on the QCD phase diagram at strong coupling by using an auxiliary field Monte-Carlo (AFMC) method. Starting from an effective action in the leading order of the $1/g^2$ and $1/d$ expansion with one species of unrooted staggered fermion, the many-body problem is solved exactly by introducing the auxiliary fields and integrating out the temporal links and quark fields. The statistical weight is still a complex number, and the sign problem remains in AFMC. For low momentum auxiliary field modes, a complex phase cancellation mechanism exists, and the weight cancellation is not serious on a small lattice. Compared with the mean field results, the transition temperature is found to be reduced by around 10 %, and the hadron phase is found to be extended in the larger chemical potential direction by around 20 %, as observed in the monomer-dimer-polymer simulations.

Probability distribution of conserved charges near chiral phase transition: Morita, in collaboration with Skokov, Friman and Redlich, investigated fluctuations of the net baryon number from a viewpoint of the probability distribution. First they investigated the baryon number probability distribution in Landau theory of phase transition, then found the substantial dependence in the shape on the critical exponents of the specific heat. Then they utilized the chiral quark-meson model with functional renormalization group method for a self-consistent treatment of the critical fluctuations. They found that genuine narrowing behavior in the tail of the probability distribution signals the influences of $O(4)$ criticality near the chiral crossover transition.

Sign problem and phase quenching in finite-density QCD: The effect of the complex phase of the fermion determinant is an important question relevant to the sign problem in finite-density QCD. Yamamoto in collaboration with Hanada and Matsuo proved that, in a certain region of the QCD phase diagram, the phase quenched approximation is exact to $O(N_f/N_c)$ for any physical observable. They also investigated the implications for the lattice simulations and confirmed good quantitative agreement between their prediction and existing lattice QCD results at $N_c = 3$. Their results indicate that the phase quenched approximation is rather good already at $N_c = 3$, and the $1/N_c$ corrections can be incorporated by the phase reweighting method without suffering from the overlap problem. The same equivalence was shown in effective models and holographic models.

Banks-Casher-type relation for the BCS gap at high density: Yamamoto in collaboration with Kanazawa and Wettig derived a new Banks-Casher-type relation relating the density of complex Dirac eigenvalues at the origin to the BCS gap of quarks at high density. Their relation is applicable to QCD and QCD-like theories without a sign problem, such as two-color QCD and adjoint QCD with baryon chemical potential, and QCD with isospin chemical potential. This provides a method to measure the BCS gap through the Dirac spectrum on the lattice.

Kinetic theory with Berry curvature from quantum field theories: A kinetic theory can be modified to incorporate triangle anomalies and the chiral magnetic effect by taking into account the Berry curvature flux through the Fermi surface. Yamamoto in collaboration with Son showed how such a kinetic theory can be derived from underlying quantum field theories. Using the kinetic theory with Berry curvature corrections, they also computed the parity-odd correlation function that is found to be identical to the result in the perturbation theory in the next-to-leading order hard dense loop approximation.

Chiral plasma instabilities: Yamamoto in collaboration with Akamatsu studied the collective modes in relativistic electromagnetic or quark-gluon plasmas with an asymmetry between left- and right-handed chiral fermions using the kinetic theory with Berry curvature corrections. They found the existence of an unstable mode which indicates the presence of a plasma instability. This “chiral plasma instability" may play important roles in heavy ion collisions and compact stars.

Effect of superfluidity on neutron star crustal oscillations: Sotani and his collaborators consider how superfluidity of dripped neutrons in the crust of a neutron star affects the frequencies of the crust’s fundamental torsional oscillations. A nonnegligible superfluid part of dripped neutrons, which do not comove with nuclei, act to reduce the enthalpy density and thus enhance the oscillation frequencies. By assuming that the quasi-periodic oscillations observed in giant flares of soft gamma repeaters arise from the fundamental torsional oscillations and that the mass and radius of the neutron star is in the range of $1.4 \leq M/M_\odot \leq 1.8$ and $10\ \mathrm{km} \leq R \leq 14\ \mathrm{km}$, we constrain the density derivative of the symmetry energy as $100\ \mathrm{MeV} \leq L \leq 130\ \mathrm{MeV}$, which is far severer than the previous one, $L \geq 50$ MeV, derived by ignoring the superfluidity.

Particle Physics Group

Particle physics is a branch of physics studying the origin of matter and space-time as well as their interactions, the most fundamental problems in Nature. Its final goal is to reveal the underlying physical laws and components of the nature. A lot of important mysteries are remaining unanswered, and this group has research activities in various directions to reach this goal.

In particle phenomenology, the current experimental results are considered to be very accurately described by the Standard Model (SM) with $SU(3) \times SU(2) \times U(1)$ gauge group. However, this model cannot be the final theory for the following reasons; it contains too many tunable parameters which can only be determined by experiments, it suffers from the hierarchy problem, and it does not contain the dark matter, dark energy and also the neutrino masses. Thus particle physics beyond the SM is actively investigated by many members of this group. The study of the Higgs sector is now one of the hot topics thanks to the LHC experiments at CERN. The Higgs sector explains the origin of the particle masses through the mechanism of the spontaneous symmetry breaking. Another important topic is the mechanism of the supersymmetry breaking. The supersymmetry is a highly attractive idea, since it solves the hierarchy problem of the SM and unifies naturally the gauge couplings of the SM at a high energy scale, suggesting a Grand Unified Theory (GUT) of gauge fields and matters. However, no experimental evidence of the supersymmetry has been observed yet. Reconciliation of the present experimental situation with theoretical requirements is highly wanted.

It is yet not known how to incorporate the principle of quantum mechanics into the gravity or the general relativity. Application of the standard quantization procedure to the general relativity is met with many serious problems, including uncontrollable UV divergence. A consistent theory of quantum gravity seems to require a new notion of space-time, which replaces the classical space-time notion that is a continuous smooth manifold. Non-commutative space-time (or fuzzy space, more generally) is one candidate, which actually has been noted to appear in quantum gravity and string theory under certain conditions. Based on this quantum space-time notion, quantum gravity is investigated by some of the group members.

String theory is a theory of one-dimensionally extended objects like string, trying to give a consistent unified theory of all the interactions and matters. To relate the string theory to the real nature, compactification is a vital step, since the consistency of the string theory requires the space-time dimension to be ten, and the extra six-dimensions must be compactified to small sizes. The mode of compactification determines the possible contents of gauge theory and matters in low energy, and finding realistic compactifications is an important topic. This is studied by the group members. However, at present infinite possibilities of compactifications are known, and non-perturbative formulation of the string theory seems to be required for it to have predictable powers to the real nature. As study in this direction, the string field theory and the M-theory are investigated by the group members.

Not only as a unified theory, the discovery of the AdS/CFT correspondence open the possibility of applying the string theory to studying dynamics of general strong coupling system. A wide range of fields including black hole physics, condensed matter physics and also quantum information theory is now investigated by means of the AdS/CFT correspondence or more general gauge/gravity duality (or holography). At the same time, this duality provides significant novel links between gauge theory and string theory. These hot topics are also actively investigated by many members of the group.

Historically the development of particle physics came hand in hand with that of field theory, which is not only a common language of particle physics but also a central tool in modern theoretical physics, including cosmology, condensed matter, and statistical physics. Thinking of this powerful generality of field theory, some of the group members study related topics in mathematical physics and integrable systems.

Here is a summary of main works of the members of the particle physics group in the academic year 2012.

Particle phenomenology and supersymmetry

—higgs phenomenology —

In 4th July 2012, ATLAS and CMS, experimental groups in CERN LHC, reported the discovery of a higgs-like new particle. Subsequently the properties of the new particle including the couplings with known particles have been measured. Further new discoveries may be anticipated in future. *Hashiba* and *Takayama* investigated phenomenological implications of a higgs coupling with staus, scalar partners of charged tau lepton in supersymmetric standard model. Such couplings may modify the higgs to diphoton rate through the quantum loop effects and also has impacts on the expected production rate of new particles at LHC. They showed that taking EW precision constraints into account, the allowed change of higgs to diphoton rate due to the coupling can not be large, less than 10 percents of the standard model contributions, on the other hand, stau production through the newly discovered higgs exchange can be dominant against Drell-Yan processes induced by standard model gauge bosons. *Hasiba* completed his master thesis on this subjects and review for the related subjects.

In light of recent Xenon100 results for dark matter direct detection, *Mitsui* and *Takayama* discussed the implications of isospin-violating dark matter models proposed by J.Feng et al in 2011 and *Mitsui* completed his master thesis on review for the subject.

— spontaneous supersymmetry breaking and non-linear sigma model —

Field theories called nonlinear sigma models capture universal structures of field degrees of freedom under spontaneous symmetry breaking. The assumed symmetry is often internal but it is also possible that the symmetry contains spacetime one such as supersymmetry. *Imai* and *Izawa* with Nakai (Tohoku) considered a novel class of constraints on chiral superfields to obtain supersymmetric nonlinear sigma models in four spacetime dimensions, which strictly combine the internal symmetry breaking with spontaneous supersymmetry breaking. The resultant massless modes can be exclusively Nambu-Goldstone bosons without their complex partners and the goldstino that is charged under the internal symmetry. The massive modes show a peculiar relation among their masses and the scales of symmetry breakings.

Quantum gravity

An ultimate goal of quantum gravity is to successfully construct a theory which does not contain space-time in its basic formulation but generates it as an emergent infrared phenomenon. An important point in such researches is the choice of fundamental variables. Among various approaches, *Sasakura* studied the tensor models which have tensors with rank more than two as fundamental variables. The tensor models recently attract a number of researchers worldwide. The models were originally proposed a long time ago by *Sasakura* and a few other groups by generalizing the matrix models, which are successful in describing two-dimensional quantum gravity, to higher dimensions. Recently, some analytical results had been obtained, which indicate that singular manifolds dominate in the models. This is a well-known pathological phenomenon in lattice approaches to Euclidean quantum gravity, and is also known to be cured by introducing a time direction. Prompted by the facts, *Sasakura* recently introduced time to the tensor models by formulating tensor models in the canonical formalism. The new model is a pure first-class constraint system, whose algebra of constraints guarantees the consistency of "local" time evolutions. This is surprising in the sense that, while it is generally impossible to obtain consistent local time evolutions in lattice-like theories, the canonical tensor models realize a discrete theory with consistent "local" time evolutions. In fact, the algebra of constraints agrees with that of the ADM constraints of general relativity in a certain formal locality limit. Furthermore, *Sasakura* showed that the canonical tensor model is unique under some physically reasonable assumptions.

String theory & SUSY gauge theories

— Nahm construction and M-brane bound states —

In superstring theories, some D-branes can end on other D-branes, and construct a bound state. One can regard the latter D-branes as obtained by deforming the former D-branes at the endpoint(s). From this point of view, this bound state is represented by a solitonic solution in the field theory on the worldvolume of the former D-branes. One can also regard the former D-branes as deformation of the latter. Corresponding to this fact, one can explicitly construct general solutions of one field theory from the solutions of the other (Known as ADHM-Nahm construction). If one can generalize this idea to the bound state of M2-branes and M5-branes in M-theory, then he would obtain non-trivial hint for the unknown theory on the worldvolume of multiple M5-branes from the known theory on multiple M2-branes, ABJM theory.

As a possible first step, *Nosaka* and *Terashima* constructed some kinds of BPS solutions in ABJM theory. Some of these solutions represent bound states consist of two M5-branes and M2-branes, which would play an important role in constructing the theory of multiple M5-branes. They also gave a one-to-one correspondence between the general solutions in ABJM theory and Nahm data(the solutions of the one dimensional field theory, from which the 4-dimensional monopole solutions are constructed by Nahm construction).

— AdS/CFT —

The AdS/CFT correspondence is one of the most important dualities in string theory. Recently, there are many attempts to understand the strong coupling dynamics in supersymmetric gauge theories by using the AdS/CFT correspondence. Especially there have been remarkable progresses of AdS/CFT correspondence owing to the applications of ideas the condensed matter physics and quantum information theory.

Nozaki, *Takayanagi* and *Ugajin* worked out the holographic dual of boundary conformal field theories in two and three dimensions, by employing the idea of AdS/BCFT correspondence proposed by *Takayanagi* before. In particular, they defined a new quantity called boundary central charge which generalized the ordinary central charge of two dimensional conformal field theories and proved that it monotonically decreases under the renormalization group flow.

Nozaki, *Takayanagi* with Ryu (Illinois) constructed a natural metric in MERA (multi scale renormalization ansatz). The MERA is a real space renormalization scheme first considered by Vidal in an application of quantum information theory to condensed matter physics. Recently MERA was conjectured to be identical to the basic mechanism of AdS/CFT by Swingle. Motivated by this conjecture, we proposed an information theoretic definition of the metric which corresponds to the metric in the extra dimension of AdS/CFT.

— holography —

Classifying the zero-temperature ground states of quantum field theories with finite charge density is a very interesting problem. Via holography, this problem is mapped to the classification of extremal charged black brane geometries with anti-de Sitter asymptotics. *Iizuka*, together with Kachru (Stanford), Kundu (Tata), Narayan (Weizmann), Sircar (Tata), and Trivedi (Tata) proposed a Bianchi classification of the extremal near-horizon geometries in five dimensions, in the case where they are homogeneous but, in general, anisotropic. With the same authors and Wang (Standord), we extended our study into several directions, including "striped" horizons.

Iizuka with Maeda (SIT) found the dynamical stripe instabilities on the geometries with hyperscaling violation

in the IR, which asymptotically approach AdS_4 in the UV. The instabilities break the translational invariance spontaneously in the boundary theory and are induced by the axion term $\sim aF \wedge F$ in the bulk action.

Iizuka with Kabat (CUNY), Roy (CUNY/IISC), and Sarkar (CUNY) analyzed the process of bound state formation in a D-brane collision. We considered two mechanisms for bound state formation. The first one is from weak coupling and the second one is from strong coupling. These two processes agree qualitatively at intermediate coupling, in accord with the correspondence principle of Horowitz and Polchinski.

Iizuka with Hashimoto (Okasa/RIKEN), and Kimura (RIKEN) proposed a new method to calculate transport phenomena of total angular momentum in holography, as a first step toward holographic understanding of spin transport phenomena. Here, the bulk spin connection becomes the source for the boundary spin current. This allows us to evaluate the spin current holographically, with a relation to the stress tensor and metric fluctuations in the bulk.

— localization and exact results —
In the study of supersymmetric gauge theories, a number of exact formulae for partition functions and other protected observables have recently been obtained by an application of localization theorem. These formulae are particularly useful in extracting certain information at strong coupling which is inaccessible from perturbative approach, for example providing evidences for dualities or studying the collective behavior of a large number of branes in M-theory.

Hosomichi and *Terashima* with Seong (Imperial Coll.) constructed general supersymmetric gauge theories on 5-sphere and showed that the non-zero contribution to the path integral localizes onto a generalization of instanton configurations on $\mathbb{CP}^2$.

Hama and *Hosomichi* found a supersymmetric 4D ellipsoid backgrounds which are suitable for generalizing the recently proposed correspondence between 4D N=2 gauge theories and 2D Toda CFTs, and provided a general formula for partition function and SUSY Wilson loop expectation values.

Hosomichi summarized the exact results on 3D SUSY gauge theories on squashed spheres and 4D superconformal indices.

— non-perturbative completion and Stokes phenomena of string theory —
Mathematically, Stokes phenomenon is a characteristic phenomenon in analysis of asymptotic divergent series. Significantly, Stokes phenomena have enough information to recover an original non-perturbative function from its perturbative asymptotic expansion series. Its application to perturbative string theory, therefore, provides a new bottom-up approach to non-perturbative formulation of string theory and is called non-perturbative reconstruction/completion of string theory. Chan (Tunghai), *Irie* and Yeh (NTU) analyzed Stokes phenomena in (p,q) minimal string theory and discussed their physical implications on non-perturbative completion of string theory. In particular, they argued that meta-stability of perturbative string theory is directly related to this information and, with use of it, decay rates of the string theory were explicitly calculated. They also showed that non-perturbative realization of string duality is relevant to Stokes phenomena, and suggested a new possibility of duality constraints on non-perturbative formulations of string theory.

— superstring field theory —
Kugo, *Kunitomo* and Zwiebach (MIT) continued to attempt to construct a field theory for the type II superstring based on the Wess-Zumino-Witten (WZW) type formulation with non-polynomial interactions. They constructed consistent kinetic and cubic interaction terms but did not yet succeed in extending them to a fully gauge-invariant non-polynomial action.

Integrable systems

— exactly solvable quantum mechanics and novel families of orthogonal polynomials—
Exactly solvable quantum mechanics, or exactly solvable eigenvalue problems of certain self-adjoint operators, is the best arena for investigating orthogonal polynomials, which offer the easiest way to realize the complete set of mutually orthogonal eigenfunctions. This series of research culminated in the discovery of various multi-indexed orthogonal polynomials by *Sasaki* and Odake (Shinshu) in 2011. In the academic year 2012 *Sasaki* with Takemura (Chuo) and Ho (YITP, Tamkang) further generalised the multi-indexed orthogonal polynomials by the confluence of apparent singularities to produce novel orthogonal polynomials having quartic poles in the weight functions. *Sasaki* and Odake unveiled infinitely many Wronskian identities among the classical orthogonal polynomials (the Hermite, Laguerre, Jacobi), which underlie the solvable structures of various quantum mechanical systems. They also introduced multi-indexed type generalisation of the solvable potentials having finitely many discrete eigenfunctions.

Yukawa International Program for Quark-Hadron Sciences

From the beginning of the academic year of 2007, Yukawa Institute for Theoretical Physics launched a new five-year project, “Yukawa International Program for Quark-Hadron Sciences (YIPQS)", sponsored by “Ministry of Education, Culture, Sports, Science and Technology, JAPAN (MEXT)". At the end of the academic year of 2010, the government approved to convert the YIPQS project budget into a more stable normal budget, and now we can run the program from a longer term point of view.

Aim of the program

By the end of 1970’s, the final understanding was reached that Quantum Chromodynamics (QCD) is the fundamental theory of the strong interaction which was originally discovered by Hideki Yukawa. Still, nevertheless, only little has been established from QCD on various possible forms of hadrons or quarks. For example, while scaling behaviors of the lepton-nucleon cross section in the deep-inelastic scattering region and some properties of ground state hadrons have been precisely understood in perturbative and lattice QCD calculations, respectively, the study of bare nuclear force just started very recently. We have not yet reached the stage to understand properties of excited hadrons above the threshold including the exotic hadrons, binding mechanism of nuclei with more than two nucleons, nuclear matter equation of state, and the vacuum structures at extremely high temperature in the Early Universe and at extremely high density in compact stars, from the fundamentaly theory, namely QCD. In other words, there is still a vast area of research interest which is to be explored. To advance our exploration, it is necessary not only to make full use of existing theoretical techniques but also to develop new theories and to establish new frameworks. The expected achievement would cast a strong impact on our understanding of various forms of matter at various levels in nature. One may face a situation that one should restructure the current understanding about possible forms of matter.

The primary purpose of the YIPQS is to establish a new area of research fields; the quark-hadron sciences. For this purpose, with cooperating with present and near-future experimental activities, Yukawa Institute for Theoretical Physics will advance theoretical research not only in quark-hadron physics but also in related areas, as listed below, which constitute indispensable building blocks for the quark-hadron sciences.

Examples of related areas include; quark-gluon plasma, hadron physics, lattice QCD, dark energy, dark matter, baryogenesis, CP violation, strongly-correlated systems, phase transition of internal degrees of freedom of matter, physics of the Early Universe, matter at extreme conditions, structure of unstable nuclei and nucleosynthesis, compact star physics, optical lattice, (super)string theory, AdS/CFT correspondence, non-perturbative and/or non-equilibrium dynamics, etc.

International collaboration program

As a core activity of the YIPQS, long-stay programs are organized on research topics ranging over quark-hadron physics and related fields of theoretical physics. The proposal of the program is open for the community, with a requirement that the organizing committee should include a member of Yukawa Institute. The theme of the long-stay program is selected by the YIPQS executive committee with taking account of comments and opinions from the international advisory committee. The program is to be endorsed by the steering/advisory committee of the Yukawa Institute. The proposed program plan is also to be examined by the user’s committee of the Yukawa Institute.

Two to three long-stay programs will be held annually; the duration of each program is one to three months. World-leading scientists are invited for each theme, and the Yukawa Institute provides participants with relaxed and at-home atmosphere so that there may be active discussions and fruitful collaborations, which we hope that will ultimately lead to Nobel-prize class results. To publicize the aim of creating and advancing the field of quark-hadron sciences, the activities and outcomes of the YIPQS will be announced regularly on the website.

Long-stay programs

In this academic year the following two long-stay programs were held;

1. Sep. 24 – Oct. 26, 2012: “Gauge/gravity duality"
   http://www2.yukawa.kyoto-u.ac.jp/ws/2012/ykis2012/ggd/index.html
   Chairman: Taichiro Kugo

2. Nov. 18 – Dec. 22, 2012: “Gravity and Cosmology 2012"
   http://www2.yukawa.kyoto-u.ac.jp/ws/2012/gc2012/
   Chairman: Takahiro Tanaka

The detailed information of each program can be seen at the website written above.

International molecule-type workshops

Smaller-size international collaboration programs are also organized to cope with the rapid development of the research in this field. The program is named a “molecule-type” international program. It is expected that the group discussion in this small program will evolve to form a research collaboration. The proposal has been received anytime within the budget limit. This program should involve at least one core participant from abroad, and should be long for two weeks or more. The selection of this program is also made by the executive committee.

In this academic year there were four international programs of this molecule-type as listed below;

1. June 15 – June 29, 2012: “Theory of X-ray spectroscopy for strongly correlated electrons"
   Core members: Tom Devereaux and Takami Tohyama

2. July 23 – Aug. 09, 2012: “Nonlinear massive gravity theory and its observational test"
   Core members: Claudia de Rham, Andrew J. Tolley and Tetsuya Shiromizu

3. Jan. 4 – Jan. 31, 2013: “Nuclear equation of state and hypernuclear physics"
   Core members: Hans-Josef Schulze, Emiko Hiyama, Akira Onishi and Naoyuki Itagaki

4. Mar. 4 – Mar. 22, 2013: “Coexistence of weak and strong binding in unstable nuclei and its dynamics"
   Core members: Antonio M.Moro Munoz, Kazuyuki Ogata, Yoshiko Kanada-En’yo and Naoyuki Itagaki

Organization

The executive committee was organized in the Yukawa Institute to run the whole program. The committee members are:
Akira Ohnishi (chair), Hisao Hayakawa, Naoyuki Itagaki, Taichiro Kugo, Teiji Kunihiro, Hiroshi Kunitomo, Misao Sasaki, Masaru Shibata, Yudai Suwa, Tadashi Takayanagi, Takahiro Tanaka, Takami Tohyama.

One special duty professor and one postdoc were hired to enhance the research activities at the Yukawa Institute.

The website of the program is;
http://www2.yukawa.kyoto-u.ac.jp/˜yipqs/index-e.html.

2.2 Publications

2.2.1 YITP preprints (January∼December 2012)

12-1 Sugumi Kanno, Misao Sasaki, Jiro Soda, *Tunneling without barriers with gravity* (January); arXiv:1201.2272[hep-th]

12-2 Claudio Bonati, Philippe de Forcrand, Massimo D'Elia, Owe Philipsen, Francesco Sanfilippo, *Constraints on the two-flavor QCD phase diagram from imaginary chemical potential* (January); arXiv:1201.2769[hep-lat]

12-3 Nathalie Deruelle, Misao Sasaki, Yuuiti Sendouda, Ahmed Youssef, *Lorentz-violating vs ghost gravitons: the example of Weyl gravity* (January); arXiv:1202.3131[gr-qc]

12-4 Atsushi Naruko, *A general proof of the equivalence between the δN and covariant formalisms* (January); arXiv:1202.1516[astro-ph.CO]

12-5 Ryo Saito, Satoshi Shirai, *Gravitational Wave Probe of High Supersymmetry Breaking Scale* (January); arXiv:1201.6589[hep-ph]

12-6 A. Martinez Torres, M. Bayar, D. Jido, E. Oset, *Strategy to find the two $\Lambda(1405)$ states from lattice QCD simulations* (February); arXiv:1202.4297[hep-lat]

12-7 Philippe de Forcrand, Aleksi Kurkela, Marco Panero, *Numerical properties of staggered quarks with a taste-dependent mass term* (February);JHEP 1204 (2012) 142 arXiv:1202.1867[hep-lat]

12-8 Ryusuke Nishikawa, Chul-Moon Yoo, Ken-ichi Nakao, *Evolution of density perturbations in large void universe* (February); arXiv:1202.1582[astro-ph.CO]

12-9 Takashi Hiramatsu, Masahiro Kawasaki, Ken'ichi Saikawa, Toyokazu Sekiguchi, *Production of dark matter axions from collapse of string-wall systems* (February); arXiv:1202.5851[hep-ph]

12-10 Kazuo Hosomichi, Rak-Kyeong Seong, Seiji Terashima, *Supersymmetric Gauge Theories on the Five-Sphere* (February); arXiv:1203.0371[hep-th]

12-11 Sugumi Kanno, Misao Sasaki, Jiro Soda, *Destabilizing Tachyonic Vacua at or above the BF Bound* (February);Prog. Theor. Phys. 128 (2012), 213-226 arXiv:1203.0612[hep-th]

12-12 Naoki Sasakura, *Uniqueness of canonical tensor model with local time* (February); arXiv:1203.0421[hep-th]

12-13 Kentaro Tanabe, Tetsuya Shiromizu, Shunichiro Kinoshita, *Angular momentum at null infinity in higher dimensions* (March); arXiv:1203.0452[gr-qc]

12-14 Hiroaki Kanno, Masato Taki, *Generalized Whittaker states for instanton counting with fundamental hypermultiplets* (March); arXiv:1203.1427[hep-th]

12-15 Kazuhiro Sakai, *Seiberg-Witten prepotential for E-string theory and random partitions* (March); arXiv:1203.2921[hep-th]

12-16 Ali Akbar Abolhasani, Hassan Firouzjahi, Shahram Khosravi, Misao Sasaki, *Local Features with Large Spiky non-Gaussianities during Inflation* (March); arXiv:1204.3722[astro-ph.CO]

12-17 Tatsuo Kobayashi, Takashi Shimomura, Tsubasa Takahashi, *Constraining the Higgs sector from False Vacua in the Next-to-Minimal Supersymmetric Standard Model* (March); arXiv:1203.4328[hep-ph]

12-18 Satoru Odake, Ryu Sasaki, *Multi-indexed (q)-Racah Polynomials* (March); arXiv:1203.5868[math-ph]

12-19 Tatsuo Kobayashi, Hiroki Makino, Ken-ichi Okumura, Takashi Shimomura, Tsubasa Takahashi, *TeV scale mirage mediation in NMSSM* (March); arXiv:1204.3561

12-20 Youngshin Kwon, Su Houng Lee, Kenji Morita, Gyuri Wolf, *A renewed look at eta' in medium* (March); arXiv:1203.6740[nucl-th]

12-21 unused, ();

12-22 Naoki Sasakura, *Fuzzy spaces from tensor models, cyclicity condition, and n-ary algebras* (March); arXiv:1203.6170[hep-th]

12-23 K. P. Khemchandani, A. Mart?nez Torres, H. Nagahiro, A. Hosaka, *Negative parity Λ and Σ resonances coupled to pseudoscalar and vector mesons* (March); arXiv:1203.6711[nucl-th]

12-24 E. Oset, D. Jido, T. Sekihara, A. Martinez Torres, K. P. Khemchandani, M. Bayar, J. Yamagata-Sekihara, *A new perspective on the Faddeev equations and the $\bar{K}NN$ system from chiral dynamics and unitarity in coupled channels* (March);Nucl. Phys. A 881, 127 (2012) arXiv:1203.4798[hep-ph]

12-25 Kenta Itahashi, Hiroyuki Fujioka, Hans Geissel, Ryugo S. Hayano, Satoru Hirenzaki, Satoshi Itoh, Daisuke Jido, Volker Metag, Hideko Nagahiro, Mariana Nanova, Takahiro Nishi, Kota Okochi, Haruhiko Outa, Ken Suzuki, Takatoshi Suzuki, Yoshiki K. Tanaka, Helmut Weick, *Feasibility Study of Observing eta' Mesic Nuclei with (p,d) Reaction* (April); arXiv:1203.6720[nucl-ex]

12-26 K. Totsuka, P. Lecheminant, S. Capponi, *Semiclassical Approach to Competing Orders in Two-leg Spin Ladder with Ring-Exchange* (April);Phys.Rev.B 86, 014435 (2012) arXiv:1204.0333[cond-mat.str-el]

12-27 Kenji Morita, *Quarkonium at $T > 0$* (April); arXiv:1204.1125[hep-ph]

12-28 Kei Suzuki, Philipp Gubler, Kenji Morita, Makoto Oka, *Thermal modification of bottomonium spectra from QCD sum rules with the maximum entropy method* (April); arXiv:1204.1173[hep-ph]

12-29 Chul-Moon Yoo, Hiroyuki Abe, Ken-ichi Nakao, Yohsuke Takamori, *Black Hole Universe: Construction and Analysis of Initial Data* (April); arXiv:1204.2411[gr-qc]

12-30 Andrea Prudenziati, *Double genus expansion for general Ω background* (April); arXiv:1204.2322[hep-th]

12-31 Tadashi Takayanagi, *Entanglement Entropy from a Holographic Viewpoint* (April);Class.Quant.Grav. 29 (2012) 153001 arXiv:1204.2450[gr-qc]

12-32 Takayasu Sekihara, Junko Yamagata-Sekihara, Daisuke Jido, Yoshiko Kanada-En'yo, *Branching ratios of mesonic and non-mesonic antikaon absorptions in nuclear medium* (April); arXiv:1204.3978[nucl-th]

12-33 Frederico Arroja, Misao Sasaki, *Strong scale dependent bispectrum in the Starobinsky model of inflation* (April);JCAP 1208 (2012) 012 arXiv:1204.6489[astro-ph.CO]

12-34 Dasiuke Jido, *Baryon resonances as dynamically generated states in chiral dynamics* (April);AIP Conf. Proc. 1432, 136-141 (2012) arXiv:1204.4534[nucl-th]

12-35 Masanori Hanada, Yoshinori Matsuo, Naoki Yamamoto, *Sign problem and phase quenching in finite-density QCD: models, holography, and lattice* (April); arXiv:1205.1030[hep-lat]

12-36 Shi Pi, Misao Sasaki, *Curvature Perturbation Spectrum in Two-field Inflation with a Turning Trajectory* (April); arXiv:1205.0161[hep-th]

12-37 Jonathan White, Masato Minamitsuji, Misao Sasaki, *Curvature perturbation in multi-field inflation with non-minimal coupling* (April); arXiv:1205.0656[astro-ph.CO]

12-38 Soichiro Isoyama, Eric Poisson, *Self-force as probe of internal structure* (April); arXiv:1205.1236[gr-qc]

12-39 Kouki Nakata, *Quantum spin pumping mediated by magnon* (April); arXiv:1201.1947v3[cond-mat.mes-hall]

12-40 Kouki Nakata, *A short note on spin pumping theory with Landau-Lifshitz-Gilbert equation under quantum fluctuation; necessity for quantization of localized spin* (April); Mod. Phys. Lett. B, 26 (2012) 1250093 arXiv:1204.2339[cond-mat.mes-hall]

12-41 Kouki Nakata, *Thermal spin pumping mediated by magnon in the semiclassical regime* (April); arXiv:1204.5811[cond-mat.mes-hall]

12-42 Masahiro Nozaki, Tadashi Takayanagi, Tomonori Ugajin, *Central Charges for BCFTs and Holography* (May);JHEP06(2012)066 arXiv:1205.1573[hep-th]

12-43 Ryoichi Nishio, Taizan Watari, Tsutomu T. Yanagida, Kazuya Yonekura, *Naive Dimensional Analysis in Holography* (May); arXiv:1205.2949[hep-ph]

12-44 K. Shizuya, *Structure and the Lamb-shift-like quantum splitting of the pseudo-zero-mode Landau levels in bilayer graphene* (May); arXiv:1205.6330[cond-mat.mes-hall]

12-45 Ken Matsuno, Hideki Ishihara, Masashi Kimura, Takamitsu Tatsuoka, *Kaluza-Klein vacuum multi-black holes in five-dimensions* (May); arXiv:1206.4818[hep-th]

12-46 Tatsuhiro Misumi, Takashi Z. Nakano, Taro Kimura, Akira Ohnishi, *Strong-coupling Analysis of Parity Phase Structure in Staggered-Wilson Fermions* (May);Phys.Rev.D86:034501,2012 arXiv:1205.6545[hep-lat]

12-47 Tatsuhiro Misumi, Taro Kimura, Akira Ohnishi, *QCD phase diagram with 2-flavor lattice fermion formulations* (June);Phys.Rev.D86:094505,2012 arXiv:1206.1977[hep-lat]

12-48 Satoru Odake, Ryu Sasaki, *Multi-indexed Wilson and Askey-Wilson Polynomials* (June); arXiv:1207.5584[math-ph]

12-49 Chuan-Tsung Chan, Hirotaka Irie, Chi-Hsien Yeh, *Analytic Study for the String Theory Landscapes via Matrix Models* (June); arXiv:1206.2351[hep-th]

12-50 Ryo Saito, Masahiro Nakashima, Yu-ichi Takamizu, Jun'ichi Yokoyama, *Resonant Signatures of Heavy Scalar Fields in the Cosmic Microwave Background* (June); arXiv:1206.2164[astro-ph.CO]

12-51 Naofumi Hama, Kazuo Hosomichi, *Seiberg-Witten Theories on Ellipsoids* (June); arXiv:1206.6359[hep-th]

12-52 Tsutomu T. Yanagida, Norimi Yokozaki, Kazuya Yonekura, *Higgs Boson Mass in Low Scale Gauge Mediation Models* (June); arXiv:1206.6589[hep-ph]

12-53 Kent Yagi, Nicolas Yunes, Takahiro Tanaka, *Slowly Rotating Black Holes in Dynamical Chern-Simons Gravity: Deformation Quadratic in the Spin* (July); arXiv:1206.6130[gr-qc]

12-54 Takumi Imai, K.-I. Izawa, Yuichiro Nakai, *Supersymmetry-Breaking Nonlinear Sigma Models* (July); arXiv:1207.1549[hep-th]

12-55 Seiji Terashima, *On Supersymmetric Gauge Theories on $S^4 x S^1$* (July); arXiv:1207.2163[hep-th]

12-56 Mohammad Hossein Namjoo, Hassan Firouzjahi, Misao Sasaki, *Multiple Inflationary Stages with Varying Equation of State* (July); arXiv:1207.3638[hep-th]

12-57 Kouichi Takemura, Ryu Sasaki, *Global solutions of certain second order differential equations with a high degree of apparent singularity* (July); arXiv:1207.5302[math.CA]

12-58 Takashi Hiramatsu, Masahiro Kawasaki, Ken'ichi Saikawa, Toyokazu Sekiguchi, *Axion cosmology with long-lived domain walls* (July); arXiv:1207.3166[hep-ph]

12-59 Kazuhiro Sakai, *Seiberg-Witten prepotential for E-string theory and global symmetries* (July); arXiv:1207.5739[hep-th]

12-60 Masato Minamitsuji, Kunihito Uzawa, *Cosmological brane systems in warped spacetime* (July); arXiv:1207.4334[hep-th]

12-61 Daisuke Jido, Eulogio Oset, Takayasu Sekihara, *The $K^- d \to \pi \Sigma n$ reaction revisited* (July); arXiv:1207.5350[nucl-th]

12-62 C.-I. Chou, C.-L. Ho, *Generalized Rayleigh and Jacobi processes and exceptional orthogonal polynomials* (July); arXiv:1207.6001[math-ph]

12-63 Chul-Moon Yoo, *Notes on Spinoptics in a Stationary Spacetime* (July); arXiv:1207.6833[gr-qc]

12-64 Tomoki Nosaka, Seiji Terashima, *M5-branes in ABJM theory and Nahm equation* (July); arXiv:1208.1108[hep-th]

12-65 Hooshyar Assadullahi, Hassan Firouzjahi, Mohammad Hossein Namjoo, David Wands, *Curvaton and the inhomogeneous end of inflation* (July); arXiv:1207.7006[astro-ph.CO]

12-66 Soichiro Isoyama, Ryuichi Fujita, Norichika Sago, Hideyuki Tagoshi, Takahiro Tanaka, *Impact of the second order self-forces on the dephasing of the gravitational waves from quasi-circular extreme mass-ratio inspirals* (July); arXiv:1210.2569[gr-qc]

12-67 Daisuke Jido, Hideko Nagahiro, Satoru Hirenzaki, Shuntaro Sakai, *eta' meson under partial restoration of chiral symmetry in nuclear medium* (August); EPJ Web of Conferences 37, 09019 (2012) arXiv:1208.0982[nucl-th]

12-68 Jaume Garriga, Sugumi Kanno, Misao Sasaki, Jiro Soda, Alexander Vilenkin, *Observer dependence of bubble nucleation and Schwinger pair production* (August); arXiv:1208.1335[hep-th]

12-69 Kazuyuki Sugimura, Daisuke Yamauchi, Misao Sasaki, *Non-Gaussian bubbles in the sky* (August); arXiv:1208.3937[astro-ph.CO]

12-70 Takuya Kanazawa, Tilo Wettig, Naoki Yamamoto, *Banks-Casher-type relation for the BCS gap at high density* (August); arXiv:1211.5332[hep-lat]

12-71 Ken Matsuno, Hideki Ishihara, Masashi Kimura, Takamitsu Tatsuoka, *Charged rotating Kaluza-Klein multi-black holes and multi-black strings in five-dimensional Einstein-Maxwell theory* (August); arXiv:1208.5536[hep-th]

12-72 Masahiro Nozaki, Shinsei Ryu, Tadashi Takayanagi, *Holographic Geometry of Entanglement Renormalization in Quantum Field Theories* (August); arXiv:1208.3469[hep-th]

12-73 Chul-Moon Yoo, Ryo Saito, Yuuiti Sendouda, Keitaro Takahashi, Daisuke Yamauchi, *Femto-lensing due to a Cosmic String* (August); arXiv:1209.0903[astro-ph.CO]

12-74 Ying-li Zhang, Ryo Saito, Misao Sasaki, *Hawking-Moss instanton in nonlinear massive gravity* (September); arXiv:1210.6224[hep-th]

12-75 Atsushi Naruko, Yu-ichi Takamizu, Misao Sasaki, *Beyond δN formalism* (September); arXiv:1210.6525[astro-ph.CO]

12-76 C.-L. Ho, R. Sasaki, K. Takemura, *Confluence of apparent singularities in multi-indexed orthogonal polynomials: the Jacobi case* (September); arXiv:1210.0207[math.CA]

12-77 Antonino Flachi, Masato Minamitsuji, Kunihito Uzawa, *Moduli Stabilization in Warped de Sitter Compactifications* (September); arXiv:1209.3978[hep-th]

12-78 Takashi Hiramatsu, Wayne Hu, Kazuya Koyama, Fabian Schmidt, *Equivalence Principle Violation in Vainshtein Screened Two-Body Systems* (September); arXiv:1209.3364[hep-th]

12-79 Mohammad Hossein Namjoo, Hassan Firouzjahi, Misao Sasaki, *Violation of non-Gaussianity consistency relation in a single field inflationary model* (October); arXiv:1210.3692[astro-ph.CO]

12-80 Daisuke Jido, *Hadronic few-body systems in chiral dynamics, – Few-body systems in hadron physics –* (October); arXiv:1210.1993[nucl-th]

12-81 H. Nagahiro, D. Jido, H. Fujioka, K. Itahashi, –S. Hirenzaki, *Formation of eta-prime(958)-mesic nuclei by (p,d) –reaction* (October); arXiv:1211.2506[nucl-th]

12-82 Andrea Prudenziati, *On recursion relations in topological –string theory* (October); arXiv:1210.4312[hep-th]

12-83 Takashi Z. Nakano, Tatsuhiro Misumi, Taro Kimura, Akira Ohnishi, *Strong coupling analysis of Aoki phase in Staggered-Wilson fermions* (October); PoS Lattice2012:203,2012 arXiv:1210.5954[hep-lat]

12-84 J. Yamagata-Sekihara, T. Sekihara, D. Jido, *Production of hyperon resonances induced by kaon on a deuteron target* (October); arXiv:1210.6108[nucl-th]

12-85 Satoru Odake, Ryu Sasaki, *Krein-Adler transformations for shape-invariant potentials and pseudo virtual states* (October); arXiv:1212.6595[math-ph]

12-86 Misao Sasaki, *Inflation and Birth of Cosmological Perturbations* (October); arXiv:1210.7880[astro-ph.CO]

12-87 Akira Furusaki, Naoto Nagaosa, Kentaro Nomura, Shinsei Ryu, Tadashi Takayanagi, *Electromagnetic and thermal responses in topological matter: topological terms, quantum anomalies and D-branes* (November); arXiv:1211.0533[cond-mat.mes-hall]

12-88 Akira Ohnishi, Terukazu Ichihara, Takashi Z. Nakano, *Auxiliary field Monte-Carlo study of the QCD phase diagram at strong coupling* (November); arXiv:1211.2282[hep-lat]

12-89 Kazuhiko Kamikado, Nils Strodthoff, Lorenz von Smekal, Jochen Wambach, *Fluctuations in the quark-meson model for QCD with isospin chemical potential* (November); arXiv:1207.0400[hep-ph]

12-90 K. Kamikado, T. Kunihiro, K. Morita, A. Ohnishi, *Functional Renormalization Group Study of Phonon Mode Effects on Chiral Critical Point* (November); arXiv:1210.8347[hep-ph]

12-91 Kenji Morita, Vladimir Skokov, Bengt Friman, Krzysztof Redlich, *Net baryon number probability distribution near the chiral phase transition* (November); arXiv:1211.4703[hep-ph]

12-92 Norihiro Iizuka, Shamit Kachru, Nilay Kundu, Prithvi Narayan, Nilanjan Sircar, Sandip P. Trivedi, Huajia Wang, *Extremal Horizons with Reduced Symmetry: Hyperscaling Violation, Stripes, and a Classification for the Homogeneous Case* (November); arXiv:1212.1948[hep-th]

12-93 Yoshimasa Hidaka, Naoki Yamamoto, *Some exact results on the QCD critical point* (November); arXiv:1211.5362[hep-lat]

12-94 K. Shizuya, *Orbital Lamb shift and mixing of the pseudo-zero-mode Landau levels in ABC-stacked trilayer graphene* (November);Phys. Rev. B 87, 085413 (2013) arXiv:1212.0338[cond-mat.mes-hall]

12-95 Dam Thanh Son, Naoki Yamamoto, *Kinetic theory with Berry curvature from quantum field theories* (October);Phys.Rev.D87:085016,2013 arXiv:1210.8158[hep-th]

12-96 Satoru Odake, Ryu Sasaki, *Extensions of solvable potentials with finitely many discrete eigenstates* (November); arXiv:1301.3980[math-ph]

12-97 Kohsuke Tsubakihara, Akira Ohnishi, *Three-body couplings in RMF and its effects on hyperonic star equation of state* (November); arXiv:1211.7208[nucl-th]

12-98 Daisuke Jido, Shuntaro Sakai, Hideko Nagahiro, Satoru Hirenzaki, Natsumi Ikeno, η' *meson under partial restoration of chiral symmetry in nuclear medium* (November); arXiv:1211.6774[nucl-th]

12-99 Jyotirmoy Bhattacharya, Masahiro Nozaki, Tadashi Takayanagi, Tomonori Ugajin, *Thermodynamical Property of Entanglement Entropy for Excited States* (December);Phys. Rev. Lett. 110, 091602 (2013) arXiv:1212.1164[hep-th]

12-100 Philipp Gubler, Kei Suzuki, Kenji Morita, Makoto Oka, *Modification of hadronic spectral functions under extreme conditions: An approach based on QCD sum rules and the maximum entropy method* (December); arXiv:1212.1594[hep-ph]

12-101 Ken-ichi Nakao, Masashi Kimura, Mandar Patil, Pankaj S. Joshi, *Ultra-high energy collision with neither black hole nor naked singularity* (December); arXiv:1301.4618[gr-qc]

12-102 Soichiro Isoyama, Norichika Sago, Hiroyuki Nakano, Ryuichi Fujita, Takahiro Tanaka, *Evolution of the Carter constant for a resonant inspiral into a Kerr black hole: I. The scalar case* (December); arXiv:1302.4035[gr-qc]

12-103 K. Narayan, Tadashi Takayanagi, Sandip P. Trivedi, *AdS plane waves and entanglement entropy* (December); arXiv:1212.4328[hep-th]

12-104 Norihiro Iizuka, Kengo Maeda, *Stripe Instabilities of Geometries with Hyperscaling Violation* (December); arXiv:1301.5677[hep-th]

12-105 J. Yamagata-Sekihara, N. Ikeno, H. Nagahiro, D. Jido, S. Hirenzaki, *Nuclear density probed by Kaon-Nucleus systems and Kaon-Nucleus interaction* (December); arXiv:1212.3383[nucl-th]

12-106 Takayasu Sekihara, Junko Yamagata-Sekihara, Daisuke Jido, Yoshiko Kanada-En'yo, *Mesonic and non-mesonic branching ratios of K^- absorption in the nuclear medium* (December); arXiv:1212.4951[nucl-th]

12-107 Hooshyar Assadullahi, Hassan Firouzjahi, Mohammad Hossein Namjoo, David Wands, *Modulated curvaton decay* (December); arXiv:1301.3439[hep-th]

12-108 Kimitake Hayasaki, Kent Yagi, Takahiro Tanaka, Shin Mineshige, *Gravitational wave diagnosis of a circumbinary disk* (December); arXiv:1201.2858[astro-ph.CO]

12-109 Kent Yagi, Nicolas Yunes, Takahiro Tanaka, *Gravitational Waves from Quasi-Circular Black Hole Binaries in Dynamical Chern-Simons Gravity* (December); arXiv:1208.5102[gr-qc]

12-110 Takahiro Tanaka, Yuko Urakawa, *Strong restriction on inflationary vacua from the local ""gauge'"" invariance I* (December); arXiv:1209.1914[hep-th]

12-111 Yusuke Korai, Takahiro Tanaka, *QFT in the flat chart of de Sitter space* (December);Phys. Rev. D 87: 024013, 2013 arXiv:1210.6544[gr-qc]

12-112 H. Kamano, S.X. Nakamura, T.S.-H. Lee, T. Sato, *Neutrino-induced forward meson-production reactions in nucleon resonance region* (December);Phys. Rev. D 86: 097503, 2012 arXiv:1207.5724[nucl-th]

12-113 S.X. Nakamura, H. Kamano, T.S.-H. Lee, T. Sato, *Extraction of Meson Resonances from Three-pions Photo-production Reactions* (December);Phys. Rev. D 86: 114012, 2012 arXiv:1209.3402[hep-ph]

12-114 Takatoshi Ichikawa, Akira Iwamoto, Peter M?ller, Arnold J. Sierk, *The contrasting fission potential-energy structure of actinides and mercury isotopes* (December); arXiv:1203.2011[nucl-th]

12-115 T. Ichikawa, N. Itagaki, Y. Kanada-En'yo, Tz. Kokalova, W. von Oertzen, *Search for three alpha states around an ^{16}O core in ^{28}Si* (December); arXiv:1206.2034[nucl-th]

12-116 T. Ichikawa, J. A. Maruhn, N. Itagaki, K. Matsuyanagi, P.-G. Reinhard, S. Ohkubo, *Existence of exotic torus configuration in high-spin excited states of ^{40}Ca* (December); arXiv:1207.6250[nucl-th]

2.2.2 Publications and Talks by Regular Staff (April 2012 — March 2013)

Hisao Hayakawa

Journal Papers

1. Kiyoshi Kanazawa Takahiro Sagawa, and Hisao Hayakawa, "Stochastic Energetics for Non-Gaussian Processes ", Phys. Rev. Lett. **108**, 210601 (1-5) (2012).
2. Michio Otsuki and Hisao Hayakawa, "Rheology of Sheared Granular Particles near Jamming Transition", Prog. Theor. Phys. Suppl. No. **195**, 129-138 (2012) .
3. Michio Otsuki and Hisao Hayakawa, "Critical scaling of a jammed system after a quench of temperature" , Phys. Rev. E **86**, 031505 (1-6) (2012).
4. Masahiro Ikeda, Hirofumi Wada and Hisao Hayakawa "Instabilities and turbulence-like dynamics in an oppositely driven binary particle mixture ", EPL **99**, 68005 (1-6) (2012).
5. Moto Araki and Hisao Hayakawa. "Step-like electric conduction in a classical two-dimensional electron system through a narrow constriction in a microchannel ". Phys. Rev. B **86**, 165412 (1-11) (2012)
6. Moto Araki and Hisao Hayakawa. "Step-like electric conduction in a classical two-dimensional electron system through a narrow constriction in a microchannel ". Phys. Rev. B **86**, 165412 (1-11) (2012).
7. Tomohiko G. Sano and Hisao Hayakawa, "Simulation of granular jets: Is granular flow really a perfect fluid? ", Phys. Rev. E **86**, 041308 (1-6) (2012).
8. Tomohiko G. Sano and Hisao Hayakawa, "Simulation of granular jets: Is granular flow really a perfect fluid? ", Phys. Rev. E **86**, 041308 (1-6) (2012).
9. Hiroto Kuninaka, and Hisao Hayakawa, "Origin of rebounds with a restitution coefficient larger than unity in nanocluster collisions", Phys. Rev. E **86**, 051302 (1-6) (2012).
10. Tatsuro Yuge, Takahiro Sagawa, Ayumu Sugita and Hisao Hayakawa, "Geometrical pumping in quantum transport: Quantum master equation approach", Phys. Rev. B **86**, 235308 (1-10) (2012) .
11. Koshiro Suzuki and Hisao Hayakawa, "Nonequilibrium mode-coupling theory for uniformly sheared underdamped systems" Phys. Rev. E **87**, 012304 (1-27) (2013).
12. Takahiro Sagawa and Masahito Ueda, "Fluctuation Theorem with Information Exchange: Role of Correlations in Stochastic Thermodynamics", Phys. Rev. Lett. **109**, 180602 (1-5) (2012).
13. Daisuke A. Takahashi, Shunji Tsuchiya, Ryosuke Yoshii, and Muneto Nitta, "Fermionic solutions of chiral Gross-Neveu and Bogoliubov-de Gennes systems in nonlinear Schrodinger hierarchy", Phys. Lett. B **718**, 632-637 (2012).
14. Ryosuke Yoshii, Giacomo Marmorini and Muneto Nitta, "Spin Imbalance Effect on Josephson Junction and Grey Soliton", J. Phys. Soc. Jpn. **81**, 094704 (1-5) (2012).
15. Tatsuhiko N. Ikeda, Yu Watanabe, and Masahito Ueda, "Finite-size scaling analysis of the eigenstate thermalization hypothesis in a one-dimensional interacting Bose gas ", Phys. Rev. E **87**, 012125 (1-5) (2013).

Books and Proceedings

1. Hisao Hayakawa edit, "Nonequilibrium Dynamics in Astrophysics and Materials Science" in Proceedings of the YITP Workshop on Econophysics Progress of Theoretical Physics Supplement No. **195**, pp.1-200 (2012). .
2. Takahiro Sagawa, "Thermodynamics of Information Processing in Small Systems", Springer, 2012 (ISBN: 978-4-431-54167-7) .
3. Kuniyasu Saitoh and Hisao Hayakawa, “Time dependent Ginzburg-Landau equation for sheared granular flow”, AIP-Conf-Proc.**1501**, 1001-1008 (2012) in 28th International Conference on Rarefied Dynamics 2012, Zaragoza, Span .
4. Satoshi Takada and Hisao Hayakawa, “Simulation of pattern dynamics of cohesive granular particles under a plane shear”AIP-Conf-Proc. **1518**, 741-744 (2013), in Proc. of 4th Symposium on Slow Dynamics in Complex Systems 2012, Sendai .

5. Koshiro Suzuki and Hisao Hayakawa, “ Nonequilibrium mode-coupling theory for uniformly sheared underdamped systems ” AIP-Conf-Proc. **1518**, 750-757 (2013), in Proc. of 4th Symposium on Slow Dynamics in Complex Systems 2012, Sendai

6. Ryosuke Yoshii, Mikio Eto, and Ian Affleck, Decoherence induced by inelastic scattering in Aharonov-Bohm ring with embedded quantum dot J. Phys.: Conf. Ser. **400**, 042076 (1-4) (2012)

Talks at International Conferences

1. Hisao Hayakawa, "Geometric Quantum Pump for Fermion Transport", in 44 Symposium on Mathematical Physics "New Developments in the Theory of Open Quantum Systems" Torun, Poland, June 20-24, 2012

2. Hisao Hayakawa, "Approach to a Nonequilibrium Steady State of Sheared Granular Particles via Mode-Coupling Theory " in 8th European Solid Mechanics Conference 2012, July 9-13, 2012 at Graz in Australia (Invited)

3. Hisao Hayakawa, "Quantum Adiabatic Pump" in Kyoto University-Durham University Joint Symposium, November 27-28 at Kyoto (Invited)

4. Hisao Hayakawa, "Mode-coupling theory for sheared dense granular liquids " in Japan-Korea Joint Seminar on Glass Transitions and Related Subjects, December 16-20 at Fukuoka (Invited)

5. Hisao Hayakawa, "Quantum Pump" in GCOE Symposium; Development of emergent new fields, February 12-14 at Kyoto University (Invited)

Invited Seminars (in Japan)

1. Hisao Hayakawa, "The world of thermodynamics: from a steam engine to a quantum pump " in GCOE public lecture, on October 14, at Kyoto University (in Japanese)

2. Hisao Hayakawa, "Nonequilibrium Liqud Theory: Is it possible to describe both jamming transition and glass transition theoretically?" on March 13-15 at Keio University (in Japanese).

Kazuo Hosomichi

Journal Papers

1. K. Hosomichi, R.-K. Seong and S. Terashima, “Supersymmetric Gauge Theories on the Five-Sphere,”
Nucl. Phys.**B865** (2012) 376 (21 pages), YITP-12-10, arXiv:1203.0371 [hep-th].

2. N. Hama and K. Hosomichi, “Seiberg-Witten Theories on Ellipsoids,” JHEP **1209**, 033 (2012) (28 pages), YITP-12-51, arXiv:1206.6359 [hep-th]; addendum JHEP **1210**, 051 (2012) (2 pages).

Talks at International Conferences

1. “Seiberg-Witten Theories on Ellipsoids,” Invited,
in “Autumn Symposium on String/M Theory,” KIAS, Seoul, Korea, September 2012.

2. “Seiberg-Witten Theories on Ellipsoids,” Invited,
in “Exact Results in SUSY Gauge Theories and Integrable Systems,” Rikkyo Research Center for Mathematical Physics, Tokyo, January 2013.

3. “Superstring theory, M-theory and the Dynamics of Branes,” Plenary,
in GCOE Symposium, Kyoto University, Kyoto, February 2013.

Invited Seminars (in Japan)

1. “M-theory and exact results in SUSY gauge theories,”
Rikkyo Research Center for Mathematical Physics, April 2012.

2. “Seiberg-Witten Theories on Sphere and Ellipsoids,”
Dept. of Phys., Univ. of Tokyo, July 2012.

3. “Seiberg-Witten Theories on Ellipsoids,”
Shinshu Univ., February 2013.

Naoyuki Itagaki

Journal Papers

1. Yoritaka Iwata, Kei Iida and Naoyuki Itagaki,
“Synthesis of this-long heavy nuclei in ternary collisions,”
Phys. Rev. C **87** (2013), 014609 (4 pages), YITP-13-18, arXiv:1211.1304 [nucl-th].

2. T. Ichikawa, J.A. Maruhn, N. Itagaki, K. Matsuyanagi, P.-G. Reinhard and S.

Ohkubo,
"Existence of exotic torus configuration in high-spin excited states of ^{40}Ca,"
Phys. Rev. Lett. **109** (2012) 232503 (4 pages), arXiv:1207.6250 [nucl-th].

3. T. Ichikawa, N. Itagaki, Y. Kanada-En'yo, Tz. Kokalova, and W. von Oertzen, "Search for three alpha states around an ^{16}O core in ^{28}Si,"
Phys. Rev. C **82** (2012) 031303(R) (5 pages), arXiv:1206.2034 [nucl-th].

Books and Proceedings

1. T. Yoshida, N. Itagaki and K. Kato, "Symplectic structure and transition properties of ^{12}C", International Symposium on Origin of Matter and Evolutions of Galaxies (OMEG) Wako, Nov 14-17, 2011, AIP Conference Proceedings **1484** 424-426 (2012) .

2. N. Itagaki, K. Muta, H.G. Masui, et al., "Simplified Modeling of Cluster-Shell Competition and Appearance of Various Cluster Structures in Light Nuclei", YKIS2011, Prog. Theor. Phys. Suppl. **196** 192-197 (2012).

Talks at International Conferences

1. "Exotic Cluster Structure of light nuclei,"
11th International Conference on Nucleus-Nucleus Collisions, San Antonio (USA), plenary invited talk, May 27- June 1 2012.

2. "Exotic Cluster Structure of light nuclei,"
Collective Motions in nuclei under Extreme conditions, Hayama (Japan), invited talk, October 22-26 2012.

Ken-Iti Izawa

Journal Papers

1. T. Imai, K.-I. Izawa and Y. Nakai,
"Supersymmetry-breaking nonlinear sigma models,"
Phys. Lett. **B717** (2012) 257-260, YITP-12-54, arXiv:1207.1549 [hep-th].

Daisuke Jido

Journal Papers

1. H. Nagahiro, D. Jido, H. Fujioka, K. Itahashi, S.Hirenzaki, "Formation of $\eta'(958)$-mesic nuclei by (p,d) reaction", âĂİPhys. Rev. **C87** (2013) 045201 (8 pages), arXiv:1211.2506 [nucl-th], YITP-12-81.âĂİ

2. J. Yamagata-Sekihara, T. Sekihara, D. Jido, âĂİ"Production of hyperon resonances induced by kaon on a deuteron target", âĂİProg. Theor. Exp. Phys. **2013** 043D02 (18 pages), arXiv:1210.6108 [nucl-th], YITP-12-84.

3. Takayasu Sekihara, Junko Yamagata-Sekihara, Daisuke Jido, Yoshiko Kanada-En'yo, âĂİ"Branching ratios of mesonic and nonmesonic antikaon absorptions in nuclear medium",âĂİPhys. Rev. **C86** (2012) 065205, arXiv:1204.3978 [nucl-th], YITP-12-32.

4. A. Martinez Torres, M. Bayar, D. Jido, E. Oset, âĂİ"Strategy to find the two $\Lambda(1405)$ states from lattice QCD simulations", âĂİPhys. Rev. **C86** (2012) 055201, arXiv:1202.4297 [nucl-th], YITP-12-6.

5. Kenta Itahashi *et al.*, "Feasibility Study of Observing η' Mesic Nuclei with (p,d) Reaction", âĂİProg. Theor. Phys. **128** (2012) 601-613, arXiv:1203.6720 [nucl-ex], YITP-12-25.

6. E. Oset, D. Jido, T. Sekihara, A.Martinez Torres, K.P. Khemchandani, M. Bayar, J. Yamagata-Sekihara, âĂİ"A new perspective on the Faddeev equations and the KbarNN system from chiral dynamics and unitarity in coupled channels", âĂİNucl. Phys. **A881** (2012) 127-140, arXiv:1203.4798 [hep-ph], YITP-12-24.

7. G. Ramalho, D. Jido, K. Tsushima, âĂİ"Valence quark and meson cloud contributions for the $\gamma^*\Lambda \to \Lambda^*$ and $\gamma^*\Sigma_0 \to \Lambda^*$ reactions", âĂİPhys. Rev. **D85** (2012) 093014, arXiv:1202.2299 [hep-ph], YITP-11-104.

8. Daisuke Jido, Hideko Nagahiro, Satoru, Hirenzaki, âĂİ"Nuclear bound state of $\eta'(958)$ and partial restoration of chiral symmetry in the η' mass", âĂİPhys. Rev.

C85 (2012) 032201(R), arXiv:1109.0394 [nucl-th], YITP-11-81.âĂİ

Books and Proceedings

1. Daisuke Jido, Hideko Nagahiro, Satoru Hirenzaki, Shuntaro Sakai, âĂİ"η' meson under partial restoration of chiral symmetry in nuclear medium", âĂİEPJ Web of Conferences **37** (2012) 09019, âĂİarXiv:1208.0982 [nucl-th], YITP-12-67.

2. Daisuke Jido, âĂİ"Baryon resonances as dynamically generated states in chiral dynamics", âĂİAIP Conference Proceedings **1432** (2012) 136-141, âĂİarXiv:1204.4534 [nucl-th], YITP-12-34.

Talks at International Conferences

1. "Hadron physics at J-PARC -exotic hadrons and hadrons in nuclei-", Invited talk, "International Symposium "Nanoscience and Quantum Physics 2012" (nanoPHYS'12), December 17-19, 2012, International House of Japan, Tokyo, Japan.

2. "η' meson under partial restoration of chiral symmetry in nuclear medium", XI International Conference on Hypernuclear and Strange Particle Physics (HYP2012), October 1-5, 2012, the Cosmocaixa, Science Museum of Barcelona, Barcelona, Spain.

3. "Hadronic few-body systems in chiral dynamics", Invited plenary talk, The 20th International IUPAP Conference on Few-Body Problems in Physics (FB20), August 20-25, 2012, Fukuoka International Congress Center, Fukuoka, Japan.

Invited Seminars (Overseas)

1. "η' meson under partial restoration of chiral symmetry in nuclear medium", Physics Department, Technische Universität München, Germany, 8 October 2012.

2. "η' meson under partial restoration of chiral symmetry in nuclear medium", Theory group, GSI, Germany, 27 September 2012.

Hiroshi Kunitomo

Invited Seminars (in Japan)

1. "Gauge Fixing of Modified Cubic Open Superstring Field Theory"
   April 25, 2012 (in Japanese), Univ. Tokyo, Komaba, Japan

2. "Gauge Fixing of Modified Cubic Open Superstring Field Theory"
   May 15, 2012 (in Japanese), Osaka City U., Osaka, Japan

3. "On the supersymmetric non-linear realization,"
   KEK Theory Workshop 2013 (in Japanese), March 18-21, 2013, Tsukuba, Japan.

Masatoshi Murase

Journal Papers

1. M. Murase and T. Murase,
   "Constructive Cognition: Extension of Self-nonself Cirulation Theory"
   Journal of Quality Education 5 29-51 (2013).

Invited Series Lectures (in Japan)

1. Living systems: Cognition and Evolution (Series Lecture), September 2012, Department of Physics, Ritsumeikan University.

Akira Ohnishi

Journal Papers

1. Tatsuhiro Misumi, Takashi Z. Nakano, Taro Kimura, Akira Ohnishi, "Strong-coupling Analysis of Parity Phase Structure in Staggered-Wilson Fermions", Phys. Rev. D **86** (2012), 034501 [17 pages], YITP-12-46, arXiv:1205.6545 [hep-lat].

2. Tatsuhiro Misumi, Taro Kimura, Akira Ohnishi, "QCD phase diagram with 2-flavor lattice fermion formulations", Phys. Rev. D **86** (2012), 094505 [12 pages], YITP-12-47, arXiv:1206.1977 [hep-lat].

3. Masahiro Isaka, Masaaki Kimura, Akinobu Doté, Akira Ohnishi, "Splitting of the p orbit in triaxially deformed $^{25}_{\Lambda}$Mg", Phys. Rev. C **87** (2013), 021304(R).

Books and Proceedings

1. Akira Ohnishi, “Phase diagram and heavy-ion collisions: Overview", Prog. Theor. Phys. Suppl. **193** (2012), 1, YITP-11-106, arXiv:1112.3210 [nucl-th].

2. A. Ohnishi, K. Miura, T. Z. Nakano, N. Kawamoto, H. Ueda, M. Ruggieri, K. Sumiyoshi, “QCD critical point in the strong coupling lattice QCD and during black hole formation", Acta Phys. Pol. B Proc. Suppl. **5** (2012), 815, YITP-11-107, arXiv:1201.6206 [nucl-th].

3. A. Ohnishi, H. Ueda, T. Z. Nakano, M. Ruggieri and K. Sumiyoshi, “QCD critical point sweep during black hole formation", AIP Conf. Proc. **1484** (2012), 327.

4. Akira Ohnishi, Terukazu Ichihara, Takashi Z. Nakano, “Auxiliary field Monte-Carlo study of the QCD phase diagram at strong coupling", PoS **LATTICE 2012** (2012), 088, YITP-12-88, arXiv:1211.2282 [hep-lat].

5. Taro Kimura, Tatsuhiro Misumi, Akira Ohnishi, “QCD Phase Diagram with 2-flavor Lattice Fermion Formulations", PoS **LATTICE 2012** (2012), 079, arXiv:1210.6357 [hep-lat].

6. Takashi Z. Nakano, Tatsuhiro Misumi, Taro Kimura, Akira Ohnishi, “Strong coupling analysis of Aoki phase in Staggered-Wilson fermions", PoS **LATTICE 2012** (2012), 203, YITP-12-83, arXiv:1210.5954 [hep-lat].

7. Chikako Ishizuka, Takuma Suda, Hideyuki Suzuki, Akira Ohnishi, Kohsuke Sumiyoshi, “Database for Nuclear EoS", PoS **NIC XII** (2012), 197.

Talks at International Conferences

1. “Auxiliary field Monte-Carlo study of the QCD phase diagram at strong coupling", The 30th International Symposium on Lattice Field Theory (Lattice 2012), Jun.24-29, 2012, Cairns, Australia.

2. “Lambda-Lambda correlation and interaction from heavy-ion collisions", International workshop on Strangeness Nuclear Physics 2012 (SNP12), Aug.27-29, 2012, Osaka EC Univ., Neyagawa, Osaka, Japan.

3. “Auxiliary field Monte-Carlo study of the QCD phase diagram at strong coupling", Renormalization Group Approach from Ultra Cold Atoms to the Hot QGP, Aug. 22-Sep. 9, 2011, Kyoto, Japan.

4. “Exotic hadrons and hadron-hadron interactions in heavy ion collisions" (Invited, Plenary), The 11th International Conference on Hypernuclear and Strange Particle Physics (HYP2012), Oct.01-Oct.05, 2012, Barcelona, Spain.

5. “Three-body coupling effects in relativistic mean field for dense matter EOS", Nuclear equation of state and hyper nuclear physics, Jan.04-31, 2013, Kyoto, Japan.

Invited Seminars (in Japan)

1. “Thermalization and chaos in relativistic heavy-ion collisions" (in Japanese), Hadron-quark matter as strongly correlated quantum many-body system, Sep. 15, 2012, Kyoto, Japan.

2. “Theoretical studies of neutron stars and nuclear matter" (in Japanese), Kickoff symposium of Grant-in-Aid for Scientific Research on Innovative Areas, “Nuclear matter in neutron stars investigated by experiments and astronomical observations", Oct. 26-27, 2012, RIKEN, Wako, Japan.

Ryu Sasaki

Journal Papers

1. C-L. Ho and R. Sasaki,
“Zeros of the exceptional Laguerre and Jacobi polynomials," ISRN Mathematical Physics **2012** 920475 (27pp),
doi:10.5402/2012/920475, YITP-11-24, arXiv:1102.5669[math-ph].

2. S. Odake and R. Sasaki,
“Multi-indexed (*q*-)Racah polynomials,"
J. Phys. **A45** (2012) 385201 (21 pp), YITP-12-18, arXiv:1203.5868[math-ph].

3. R. Sasaki and K. Takemura,
“Global solutions of certain second order

differential equations with a high degree of apparent singularity,"
SIGMA **8** (2012) 085 (18pp), YITP-12-57, arXiv:1207.5302[math.CA].

4. S. Odake and R. Sasaki,
"Multi-indexed Wilson and Askey-Wilson polynomials,"
J. Phys. **A46** (2013) 045204 (22 pp), YITP-12-48, arXiv:1207.5584[math-ph].

5. C.-L. Ho, R. Sasaki and K. Takemura,
"Confluence of apparent singularities in multi-indexed orthogonal polynomials: the Jacobi case,"
J. Phys. **A46** (2013) 115205 (21pp), YITP-12-76,arXiv:1210.0207[math.CA].

6. S. Odake and R. Sasaki,
"Extensions of solvable potentials with finitely many discrete eigenstates,"
J. Phys. **A46** (2013) 235205 (15pp), YITP-12-96,arXiv:1301.3980[math-ph].

7. S. Odake and R. Sasaki,
"Krein-Adler transformations for shape-invariant potentials and pseudo virtual states," J. Phys. **A46** (2013) 245201 (24pp), YITP-12-85,arXiv:1212.6595[math-ph]

Talks at International Conferences

1. "Exactly Solvable Quantum Mechanics and Multi-indexed Orthogonal Polynomials," Invited,
in "The XXIX International Colloquium on Group-Theoretical Methods in Physics," Nankai University, Tianjin, China
August 2012.

2. Multi-indexed q-Racah and Askey-Wilson Polynomials, Invited,
in 2013 Joint Mathematics Meeting of American Mathematical Society, San Diego, USA,
January 2013.

Invited Seminars (Overseas)

1. "Confluence of apparent singularities in multi-indexed orthogonal polynomials,"
Taipei String seminar, National Taiwan University, Taipei, Taiwan, December 2012.

2. "Heisenberg operators,"
Chungyuan University, Taiwan, December 2012.

Invited Seminars (in Japan)

1. "Confluence of apparent singularities in multi-indexed orthogonal polynomials,"
in Geometry, Mathematical Physics, and Quantum Theory 20th Numadzu Workshop, Numadzu National College of Technology
Numadzu, February 2013 (in Japanese).

Misao Sasaki

Journal Papers

1. K. Sugimura, D. Yamauchi and M. Sasaki, "Multi-field open inflation model and multi-field dynamics in tunneling," JCAP **1201**, 027 (2012) [arXiv:1110.4773 [gr-qc]].

2. Y. -l. Zhang and M. Sasaki, "Screening of cosmological constant in non-local cosmology," Int. J. Mod. Phys. D **21**, 1250006 (2012) [arXiv:1108.2112 [gr-qc]].

3. J. -O. Gong, J. -c. Hwang, W. -I. Park, M. Sasaki and Y. -S. Song, "Conformal invariance of curvature perturbation," JCAP **1109**, 023 (2011) [arXiv:1107.1840 [gr-qc]].

4. S. Kanno, M. Sasaki and J. Soda, "Holographic Dual of de Sitter Universe with AdS Bubbles," Nucl. Phys. B **855**, 361 (2012) [arXiv:1107.1491 [hep-th]].

5. A. A. Abolhasani, H. Firouzjahi and M. Sasaki, "Curvature perturbation and waterfall dynamics in hybrid inflation," JCAP **1110**, 015 (2011) [arXiv:1106.6315 [astro-ph.CO]].

6. F. Arroja, A. E. Romano and M. Sasaki, "Large and strong scale dependent bispectrum in single field inflation from a sharp feature in the mass," Phys. Rev. D **84**, 123503 (2011) [arXiv:1106.5384 [astro-ph.CO]].

7. D. Yamauchi, A. Linde, A. Naruko, M. Sasaki and T. Tanaka, "Open inflation in the landscape," Phys. Rev. D **84**, 043513 (2011) [arXiv:1105.2674 [hep-th]].

8. C. -M. Yoo, S. Tanzawa and M. Sasaki, "Gregory-Laflamme instability of a slowly rotating black string," Int. J. Mod. Phys. D **20**, 963 (2011) [arXiv:1103.6081 [hep-th]].

9. A. Naruko and M. Sasaki, “Conservation of the nonlinear curvature perturbation in generic single-field inflation,” Class. Quant. Grav. **28**, 072001 (2011) [arXiv:1101.3180 [astro-ph.CO]].

10. N. Deruelle, M. Sasaki, Y. Sendouda and A. Youssef, “Inflation with a Weyl term, or ghosts at work,” JCAP **1103**, 040 (2011) [arXiv:1012.5202 [gr-qc]].

11. S. ’i. Nojiri, S. D. Odintsov, M. Sasaki and Y. -l. Zhang, “Screening of cosmological constant in non-local gravity,” Phys. Lett. B **696**, 278 (2011) [arXiv:1010.5375 [gr-qc]].

12. J. -O. Gong and M. Sasaki, “Waterfall field in hybrid inflation and curvature perturbation,” JCAP **1103**, 028 (2011) [arXiv:1010.3405 [astro-ph.CO]].

13. A. E. Romano and M. Sasaki, “Spatial averaging and apparent acceleration in inhomogeneous spaces,” Gen. Rel. Grav. **44**, 353 (2012) [arXiv:0905.3342 [astro-ph.CO]].

Talks at International Conferences

1. “Delta N Formalism and Superhorizon Curvature Perturbation,” Invited, “Cosmological Non-Gaussianity: Observations Confront Theory Workshop," 13 – 15 May, U Michigan, Ann Arbor, USA.

2. “Delta N Formalism and Curvature Perturbations on Superhorizon Scales," Invited, Conference on “Cosmology Since Einstein," 30 May – 1 June, HKUST, Hong Kong.

3. “Open inflation in the landscape," Invited, Takehara workshop on “Theoretical Physics," 6 – 8 June, Takehara, Japan.

4. “Open Inflation in the Landscape," Invited, 5th PI/Solvay/APC joint workshop on “Cosmological Frontiers in Fundamental Physics," 14 – 17 June, APC Paris, France.

5. “Non-Gaussianity from inflation," Invited, WKYC 2011 “Future of Large Scale Structure Formation," 27 June – 1 July, KIAS Seoul, Korea.

6. “Bigbang, Inflation and Quantum Cosmology," Public Lecture, 2011 APCTP International School on “Numerical Relativity and Gravitational Waves,” 28 July – 3 August, APCTP Pohang, Korea.

7. “Conformal-invariance of curvature perturbation and related issues," Invited, Informal Workshop on “Theoretical Cosmology," 15 – 23 September, U Portsmouth, UK.

8. “Open inflation in the string landscape," Invited, Xth International Conference on “Gravitation, Astrophysics and Cosmology (ICGAC10),” Invited, 17 – 22 December, Quy-Nhon, Vietnam.

9. “Cosmology Now and Tomorrow," Key Note Talk, 2012 KASI-YITP Joint-Workshop: “Cosmology Now and Tomorrow," 17 – 18 February, KASI Daejeon, Korea.

10. “Testing the string theory landscape in cosmology," Invited, The 5th workshop on “Superstring Theory and Cosmology," 21 – 23 February, Beppu, Japan

Invited Seminars (Overseas)

1. “Open inflation in the string theory landscape," ASC cosmology seminar, 6 May, ASC Munich, Germany.

2. “Open Inflation in the Landscape,” Joint Tufts/CfA/MIT Cosmology Seminar, 10 May, MIT, USA.

3. “Testing the string theory landscape in cosmology,” CCPP HEP Seminar, 21 March, CCPP NYU, USA.

Naoki Sasakura

Journal Papers

1. N. Sasakura,
“Uniqueness of canonical tensor model with local time,”
Int. J. Mod. Phys. A **27** (2012) 1250096, YITP-12-12, arXiv:1203.0421 [hep-th].

2. N. Sasakura,
“A canonical rank-three tensor model with a scaling constraint,”
Int. J. Mod. Phys. A **28** (2013) 1, YITP-13-11, arXiv:1302.1656 [hep-th].

Books and Proceedings

1. N. Sasakura,
   "Fuzzy spaces from tensor models, cyclicity condition, and n-ary algebras,"
   Proceedings of the Corfu Summer Institute 2011 'School and Workshops on Elementary Particle Physics and Gravity', September 4-18, 2011, Corfu, Greece, PoS CORFU **2011** (2011) 059,
   YITP-12-22, arXiv:1203.6170 [hep-th].

2. N. Sasakura, "Canonical Tensor Model with Local Time and its Uniqueness," Proceedings of The XXIX International Colloquium on Group-Theoretical Methods in Physics, August 20-26, 2012, Chern Institute of Mathematics, Tianjin, China,
   YITP-13-16, arXiv:1302.5464 [hep-th].

Talks at International Conferences

1. "Canonical Tensor model with local time and its uniqueness," Invited,
   in "The XXIX International Colloquium on Group-Theoretical Methods in Physics," Chern Institute of Mathematics, Tianjin, China, August, 2012.

Invited Seminars (Overseas)

1. "Canonical tensor models with local time," Perimeter Institute for Theoretical Physics, Canada, November, 2012.

Masaru Shibata

Journal Papers

1. B.D. Lackey, K. Kyutoku, M. Shibata, P.R Brady, and J.L. Friedman,
   "Extracting equation of state parameters from black hole-neutron star mergers.I. Nonspinning black holes",
   Phys. Rev. D **85** (2012) 044061-1–21.

2. M. Shibata and Y.I. Sekiguchi,
   "Radiation Magnetohydrodynamics for Black Hole-Torus System in Full General Relativity: A Step toward Physical Simulation,"
   Prog. Theor. Phys. **127** (2012) 535–559.

3. K. Kiuchi, Y. Sekiguchi, and K. Kyutoku, and M. Shibata,
   "Gravitational waves, neutrino emissions and effects of hyperons in binary neutron star mergers,"
   Class. Quantum Grav. **29** (2012) 124003.

4. Y. Sekiguchi, K. Kiuchi, K. Kyutoku, and M. Shibata,
   "Current Status of Numerical-Relativity Simulations in Kyoto,"
   Prog. Theor. Expe. Phys. **01** (2012) A304-1–49.

5. S. Yoshida, K. Kiuchi, and M. Shibata,
   "Stably stratified magnetized stars in general relativity,"
   Phys. Rev. D **86** (2012) 044012-1–16.

6. K. Kiuchi, K. Kyutoku, and M. Shibata,
   "Three dimensional evolution of differentially rotating magnetized neutron stars,"
   Phys. Rev. D **86** (2012) 064008-1–18.

7. V. Cardoso, *et al.*,
   "NR/HEP: roadmap for the future,"
   Class. Quantum Grav. **29** (2012) 0244001-1–54.

8. K. Hotokezaka, K. Kiuchi, K. Kyutoku, H. Okawa, Y. Sekiguchi, M. Shibata, and K. Taniguchi,
   "The mass ejection from the merger of binary neutron stars,"
   Phys. Rev. D **87** (2013) 024001-1–27.

9. K. Hotokezaka, K. Kyutoku, and M. Shibata,
   "Exploring tidal effects of coalescing binary neutron stars in numerical relativity,"
   Phys. Rev. D **87** (2013) 044001-1–15.

Talks at International Conferences

1. "Instabilities of Myers-Perry black holes" (invited) in "AdS-CFT workshop", Perimeter Institute, Canada, June 4–8, 2012.

2. "Numerical simulation for binary neutron star mergers" (invited) in "Gamma-ray Bursts in the Era of Rapid Follow-up", Liverpool, England, June 18–22, 2012.

3. "Numerical simulation for binary neutron star mergers" (as a session chair) in "AN5 session of 13th Marcel Grossmann Meeting", Stockholm, Sweden, July 1–7, 2012.

4. "Numerical simulations of gravitational waves with matter " (invited) in "Gravitational Wave and Electromagnetic Studies of

Compact Binary Mergers", Santa Barbara, USA, July 30–Aug. 3, 2012.

5. "Virial relation and first law in sclar-tensor theories of gravity" (invited) in "Strong gravity beyond GR", Lisbon, Portugal, March 5–8, 2013.

Invited Seminars (Overseas)

1. "Numerical-relativity studies of neutron star binaries: Status and issues,"
   Department of Physics, University of Illinois at Urbana-Champaign, USA, Oct. 10, 2012.

Yudai Suwa

Journal Papers

1. T. Takiwaki, K. Kotake, and Y. Suwa, "Three-dimensional Hydrodynamic Core-collapse Supernova Simulations for an 11.2 $M_\odot$ Star with Spectral Neutrino Transport", ApJ 749 (2012) 98 (17 pages), arXiv:1108.3989 [astro-ph.HE]

2. H. Nagakura, Y. Suwa, and K. Ioka, "Population III Gamma-Ray Bursts and Breakout Criteria for Accretion-powered Jets",
   ApJ 754 (2012) 85 (21 pages), arXiv:1104.5691 [astro-ph.HE]

3. K. Kotake, K. Sumiyoshi, S. Yamada, T. Takiwaki, T. Kuroda, Y. Suwa, and H. Nagakura , "Core-Collapse Supernovae as Supercomputing Science: a status report toward 6D simulations with exact Boltzmann neutrino transport in full general relativity", PTEP 2012 (2012) 01A301 (34 pages), arXiv:1205.6284 [astro-ph.HE]

4. D. Nakauchi, Y. Suwa, T. Sakamoto, K. Kashiyama, and T. Nakamura, "Long-duration X-Ray Flash and X-Ray-rich Gamma-Ray Bursts from Low-mass Population III Stars",
   ApJ 759 (2012) 128 (9 pages), arXiv:1207.2835 [astro-ph.HE]

5. K. Kotake, T. Takiwaki, Y. Suwa, W. I. Nakano, S. Kawagoe, Y. Masada, and S. Fujimoto, "Multimessengers from core-collapse supernovae: multidimensionality as a key to bridge theory and observation", Advances in Astronomy, 2012 (2012) 428757 (46 pages), arXiv:1204.2330 [astro-ph.HE]

6. Y. Suwa, "Neutrino acceleration by bulk matter motion and explosion mechanism of gamma-ray bursts",
   MNRAS 428 (2013) 2443–2449, arXiv:1210.4162 [astro-ph.HE]

7. Y. Suwa, T. Takiwaki, K. Kotake, T. Fischer, M. Liebendörfer, and K. Sato, "On the Importance of the Equation of State for the Neutrino-driven Supernova Explosion Mechanism",
   ApJ 764 (2013) 99 (19 pages), arXiv:1212.6431 [astro-ph.HE]

Talks at International Conferences

1. "Axisymmetric simulation of core-collapse supernovae with spectral neutrino transfer", invited,
   in "Core-Collapse Supernovae: Models and Observable Signals", University of Washington, Seattle, USA,
   July 2012.

2. "Physical Ingredients in Core-Collapse Supernova Explosion Mechanism", invited,
   in "Quarks to Universe in Computational Science", Nara, Japan,
   December 2012.

Fumihiro Takayama

Talks at International Conferences

1. ""Long-Lived Massive Particles and the Recent Topics," Invited,
   in "Dark Matter Phenomenology, APCTP workshop," APCTP. Pohang, R.Korea,
   August 2012.

Tadashi Takayanagi

Journal Papers

1. T. Takayanagi,
   "Entanglement Entropy from a Holographic Viewpoint,"
   Class. Quant. Grav. **29** (2012) 153001, YITP-12-31, arXiv:1204.2450 [gr-qc].

2. M. Nozaki, T. Takayanagi and T. Ugajin,
"Central Charges for BCFTs and Holography,"
JHEP **1206** (2012) 066, YITP-12-42, arXiv:1205.1573 [hep-th].

3. M. Nozaki, S. Ryu and T. Takayanagi,
"Holographic Geometry of Entanglement Renormalization in Quantum Field Theories,"
JHEP **1210** (2012) 193, YITP-12-72, arXiv:1208.3469 [hep-th].

4. J. Bhattacharya, M. Nozaki, T. Takayanagi and T. Ugajin,
"Thermodynamical Property of Entanglement Entropy for Excited States,"
Phys. Rev. Lett. 110, **091602** (2013), YITP-12-220, arXiv:1212.1164 [hep-th].

Talks at International Conferences

1. "Strange Metals and Holographic Entanglement Entropy," Invited,
in "Progress in Quantum Field Theory and String Theory," Osaka City University, Osaka, Japan,
April 2012.

2. "Developments of Holographic Entanglement Entropy," Invited,
in "KITP conference: Blackholes and Information", KITP, UCSB, USA,
May 2012.

3. "Holographic Dual of BCFT," Invited ,
in "A London Satellite Meeting: Branes and Black Holes", King's College London, UK,
May 2012.

4. "Holographic Entanglement Entropy and Entanglement Renormalization," Invited,
in "Discussion Meeting on String Theory", ICTS, Bangalore, India,
June 2012.

5. "Introduction to Gravitational Holography", and "Geometric Calculations of Entanglement Entropy via Holography," Invited ,
in "International Workshop : Physics of information, information in physics, and the demon", Institute for Molecular Science, Okazaki, Japan,
June 2012.

6. "Holographic Entanglement Entropy: from Condensed Matter to Emergent Spacetime ," Invited ,
in "Gravity Theories and Their Avatars", Crete Center of Theoretical Physics, Heraklion, Greece,
July 2012.

7. "Recent developments in holographic entanglement entropy," Invited ,
in "International Symposium Ahrenshoop on the Theory of Elementary Particles", Berlin, Germany,
August 2012.

8. "Emergent spacetimes from entanglement renormalization," Invited,
in "Workshop on RG flows, holography, and entanglement entropy", the Michigan Center for Theoretical Physics, USA,
September 2012.

9. "Entanglement and Holography," Invited,
in "Entanglement in Discrete and Continuous Quantum Systems", Princeton Center for Theoretical Physics, USA,
October 2012.

10. "Holographic Entanglement Entropy and Emergent Spacetime," Invited ,
in "Workshop: Entangle This: Strings, Fields and Atoms", IFT UAM-CSIC, Madrid, Spain,
November, 2012.

11. "Entanglement Entropy and Holography," Invited, Lectures,
in "7th Asian Winter School on Strings, Particles and Cosmology", Beijing, China,
February, 2013.

Talks at Domestic Conferences

1. "AdS/CFT and Condensed Matter Physics," Invited,
in "YITP workshop: Field Theory and String Theory", YITP, Kyoto U., Kyoto, Japan,
July, 2012.

2. "Entanglement Entropy and Thermodynamical First Law," Invited,
in "Shizuoka University Intensive Seminars in Particle Physics", Shizuoka U., Shizuoka, Japan,
March 2013.

3. “From Quantum Many-Body Systems to Quantum Gravity,” Invited,
in “JPS meeting”, Hiroshima U., Hiroshima, Japan,
March 2013.

Takahiro Tanaka

Journal Papers

1. K. Hayasaki, K. Yagi and T. Tanaka, S. Mineshige,
“Gravitational wave diagnosis of a circumbinary disk,”
Phys. Rev. **D87** (2013) 044051 (12 pages), YITP-12-108, arXiv:1201.2858 [astro-ph.CO].

2. K. Yagi, N. Yunes and T. Tanaka,
“Slowly Rotating Black Holes in Dynamical Chern-Simons Gravity: Deformation Quadratic in the Spin,”
Phys. Rev. **D86** (2012) 044037 (20 pages), YITP-12-53, arXiv:1206.6130 [gr-qc].

3. K. Yagi, N. Yunes and T. Tanaka,
“Gravitational Waves from Quasi-Circular Black Hole Binaries in Dynamical Chern-Simons Gravity,”
Phys. Rev. Lett. **109** (2012) 251105 (5 pages), YITP-12-109, arXiv:1208.5102 [gr-qc].

4. S. Isoyama, R. Fujita, N. Sago, H. Tagoshi and T. Tanaka,
“Impact of the second order self-forces on the dephasing of the gravitational waves from quasi-circular extreme mass-ratio inspirals,”
Phys. Rev. **D87** (2013) 024010 (14 pages), YITP-12-66, arXiv:1210.2569 [gr-qc].

5. Y. Korai and T. Tanaka,
“QFT in the flat chart of de Sitter space,”
Phys. Rev. **D87** (2013) 024013, YITP-12-112, arXiv:1210.6544 [gr-qc].

Talks at International Conferences

1. “Gravitational wave oscillations in bigravity theory,” Invited,
in “Strong Gravity Beyond GR: from theory to observations,” Lisbon, Portugal, March 2013.

2. “Infrared Phenomena of Field Theory in de Sitter space,” Invited,
in “Asia-Pacific School on Gravity and Cosmology,” Jeju, Korea,
Feb. 2013.

3. “Gravitational wave oscillations in bigravity theory,”
in “TJ2012: Japan/Thai workshop in cosmology,” Pattaya, Thailand, Dec. 2012.

4. “Modified gravity theory and Gravitational waves,” Invited,
in “PPC2012,” KIAS, Korea, Nov. 2012.

5. “IR problem: connection to the consistency relation and the initial condition of the universe,” Invited,
in “Modern Cosmology: Early Universe, CMB and LSS,” Benasque, Spain,
August 2012.

6. “Infrared divergences in cosmological perturbation theory,” Invited,
in “Ginzburg Conference,” Moskow, Russia,
June 2012.

Invited Seminars (Overseas)

1. “Adiabatic approximation to the gravitational waveform for extreme mass-ratio inspirals,”
INR, Moscow, Russia, March 2013.

2. “Infrared divergences in cosmological perturbation theory,”
Nuresuan Univ. Thai, April 2012.

Invited Seminars (in Japan)

1. “How to test the Einstein gravity using gravitational waves,”
ICRR, Feb 2013 (KAGRA F2F meeting).

2. “An easy way to get the gravitational wave templates for Extreme mass ratio inspiral,”
Dept. of Phys., Osaka City Univ., Jan. 2013.

Seiji Terashima

Journal Papers

1. T. Nosaka and S. Terashima, “M5-branes in ABJM theory and Nahm equation,”
   Phys. Rev. D **86** (2012) 125027 (11 pages), YITP-12-64, arXiv:1208.1108 [hep-th].

Invited Seminars (in Japan)

1. “On 5d gauge theory and M5-branes,”
   Dept. of Phys., Kyoto Univ., June 2012.
2. “On the exact results of supersymmetric gauge theories,”
   Dept. of Phys., Keio Univ., June 2012 (Kansai-Chiki smeinar).

Keisuke Totsuka

Journal Papers

1. K. Totsuka, P. Lecheminant and S. Capponi,
   “Semiclassical approach to competing orders in a two-leg spin ladder with ring exchange,”
   Phys. Rev. **B 86** (2012) 014435 (14 pages).
2. K. Hasebe and K. Totsuka,
   “Quantum entanglement and topological order in hole-doped valence-bond solid states,”
   Phys. Rev. **B 87** (2013) 045115 (21 pages).
3. K. Hasebe and K. Totsuka,
   “Topological Many-Body States in Quantum Antiferromagnets via Fuzzy Supergeometry,”
   Symmetry **5** (2013) 119-214.

Talks at International Conferences

1. “Featureless spin liquid phases in high magnetic field,”,
   in “Theory of Quantum Gases and Quantum Coherence,” École Normale Supérieure, Lyon, France,
   June 2012.
2. “Geometric phases in magnetization plateaus –Possible spin-liquid in high magnetic field,”,
   in “New Development of Statistical Physics,” University of Tokyo, Tokyo, Japan,
   December 2012.

Invited Seminars (Overseas)

1. “SUSY VBS models - dynamics, topological order, etc.,”
   IRSAMC, University of Toulouse, Toulouse, France, May 2012.
2. “Symmetry-Protected Topological Orders in 1D - from cold atoms to supersymmetric VBS,”
   ITP, Leipniz University Hannover, Hannover, Germany, March 2013.

Invited Seminars (in Japan)

1. “Symmetry-Protected Topological Orders in 1D - from VBS models to cold fermions,”
   Dept. of Phys., Kyoto University, March 2013.

2.2.3 Publications and Talks by Research Fellows and Graduate Students (April 2012– March 2013)

Norihiro Iizuka

Journal Papers

1. N. Iizuka, S. Kachru, N. Kundu, P. Narayan, N. Sircar, S. P. Trivedi and H. Wang, "Extremal Horizons with Reduced Symmetry: Hyperscaling Violation, Stripes, and a Classification for the Homogeneous Case," JHEP **1303**, 126 (2013) (51 pages), YITP12-92, arXiv:1212.1948[hep-ph].

2. N. Iizuka and K. Maeda, "Stripe Instabilities of Geometries with Hyperscaling Violation," Phys. Rev. **D87** (2013) 126006 (16 pages), YITP-12-104, arXiv:1301.5677 [hep-ph].

3. N. Iizuka, D. Kabat, S. Roy and D. Sarkar, "Black Hole Formation at the Correspondence Point," Phys. Rev. **D87** (2013) 126010 (11 pages), YITP-13-21, arXiv:1303.7278 [hep-th].

Invited Seminars (in Japan)

1. "Holography: Gravity, black holes, and condensed matter physics," Dept. of Phys., Nihon Univ., Oct 2012 (in Japanese).

Hirotaka Irie

Journal Papers

1. C.-T. Chan, H Irie and C.-H. Yeh, "Analytic study for the string theory landscapes via matrix models," Phys. Rev. **D86** (2012) 126001 (7 pages), YITP-12-49, arXiv:1206.2351 [hep-th].

Talks at International Conferences

1. "Landscapes of Minimal String Theory," in YKIS 2012"From Gravity to Strong Coupling Physics," YITP, Kyoto Japan October, 2012.

Invited Seminars (in Japan)

1. "Stokes Phenomena and Quantum Integrability in Non-critical String/M Theory," YITP, Kyoto Univ., April 2012.

2. "Stokes Phenomena and Quantum Integrability in Non-critical String/M Theory," Dept. of Phys., Tokyo Univ. Komaba Campase, May 2012.

3. "Stokes Phenomena and Quantum Integrability in Non-critical String/M Theory," Dept. of Phys., Nagoya Univ., May 2012.

4. "Stokes Phenomena and Quantum Integrability in Non-critical String/M Theory," Okayama Institute of Quantum Optics., May 2012.

5. "Stokes Phenomena and Quantum Integrability in Non-critical String/M Theory," Dept. of Phys., Tokyo Institute of Technology, June 2012.

6. "Stokes Phenomena and Quantum Integrability and the use of instantons for the string theory landscapes," Dept. of Phys., Tokyo Institute of Technology (Japan-Russia Working Seminar No. 9), June 2012.

7. "General $k \times k$ isomonodromy systems and multi-cut matrix models," Dept. of Math., Osaka Univ. (Classical Anaysis Seminar), October 2012.

8. "Stokes phemonena in matrix models and string theory," Dept. of Phys., Shizuoka Univ., November 2012.

9. "Toward analytic study for the string theory landscapes via non-perturbative reconstruction," Kansai Particle Physics Seminar, Osaka, November 2012.

10. "Analytic study for the string theory landscapes via matrix models," KEK, KEK String Advanced Lectures, February 2013.

Soichiro Isoyama

Journal Papers

1. S. Isoyama, and E. Poisson,
   "Self-force as probe of internal structure,"
   Class. Quant. Grav. **29** (2012) 155012 (18 pages), YITP-12-28, arXiv:1205.1236 [gr-qc].

2. S. Isoyama, R. Fujita, N. Sago H. Tagoshi and T. Tanaka,
   "Impact of the second order self-forces on the dephasing of the gravitational waves from quasi-circular extreme mass-ratio inspirals,"
   Phys. Rev. **D87** (2013) 024010 (16 pages), YITP-12-66, arXiv:1108.6207 [gr-qc].

3. S. Isoyama, R. Fujita, H. Nakano N. Sago and T. Tanaka,
   "Evolution of the Carter constant for a resonant inspiral into a Kerr black hole: I. The scalar case,"
   Prog. Theor. Exp. Phys. (2013) 063E01 (18 pages), YITP-12-102, arXiv:1302.4035 [gr-qc].

Talks at International Conferences

1. "The post-adiabatic corrections to the gravitational wave phase for quasi-circular EMRI into a Kerr black hole,",
   in "15th CAPRA meeting," Maryland, USA,
   Jun 2012.

2. "Adiabatic evolution of resonant orbits on Kerr space time ,",
   in "JGRG22," Hongo, Japan,
   Nobember 2012.

3. "Adiabatic evolution of resonance orbits on Kerr space time ,",
   in "11th DECIGO workshop (in GC2012)," Kyoto, Japan,
   Nobember 2012.

4. "Toward the adiabatic evolution of the extreme-mass-ratio inspirals in resonance,",
   in " The Sixth Workshop on Black Hole Magnetospheres," Hsinchu, Taiwan,
   March 2013.

Invited Seminars (Overseas)

1. "Adiabatic evolution of the Carter constant at resonance due to radiation reaction,"
   DAMTP, Cambridge University, U.K., January 2013.

2. "Cosmic censorship in overcharging a black hole with a charged particle,"
   University fo Southampton, U.K., January 2013.

Hantao Lu

Journal Papers

1. Hantao Lu, Shigetoshi Sota, Hiroaki Matsueda, Janez Bonča, and Takami Tohyama,
   "Enhanced Charge Order in a Photoexcited One-Dimensional Strongly Correlated System,"
   Phys. Rev. Lett. **109** (2012) 197401, arXiv:1204.1107[cond-mat].

Talks at International Conferences

1. "Photoinduced charge order enhancement in one-dimensional extended Hubbard model,"
   in "The 19th International Conference on Magnetism," Busan, South Korea,
   July 2012.

Invited Seminars (Overseas)

1. "Photoinduced charge order enhancement in one-dimensional extended Hubbard model,"
   Lanzhou University, Lanzhou, China, December 2012.

Kenji Morita

Journal Papers

1. K. Morita and S. H. Lee,
   "Charmonium mass in hot and dense hadronic matter",
   Phys. Rev. C**85** (2012) 044917 (11 pages), arXiv:1012.3110.

2. Y. Kwon, S. H. Lee, K. Morita and G. Wolf
   "Renewed look at η' in medium"
   Phys. Rev. D**86** (2012) 034014 (6 pages), arXiv:1203.6740, YITP-12-20.

3. K. Suzuki, P. Gubler, K. Morita and M. Oka,
"Thermal modification of bottomonium spectra from QCD sum rules with the maximum entropy method",
Nucl. Phys. **A897** (2012) 28–41, arXiv:1204.1173, YITP-12-28.

4. K. Kamikado, T. Kunihiro, K. Morita and A. Ohnishi,
"Functional renormalization group study of phonon mode effects on chiral critical point",
Prog. Theor. Exp. Phys. **2013**, 053D01 (14 pages).

Books and Proceedings

1. K. Morita, V. Skokov, B. Friman and K. Redlich,
"Probing deconfinement in the Polyakov-loop extended Nambu-Jona-Lasino model at imaginary chemical potential",
Proceedings of "Three Days on Quarkyonic Island", HIC for FAIR workshop and XXVIII Max Born Symposium, Wroclaw, 19-21 May 2011. Acta Physica Polonica B Proceedings Supplement B No.**5**, (2012) 803–813, arXiv:1111.3446, YITP-11-95.

2. K. Morita
"Quarkonium at $T > 0$",
Proceedings of XLI International Symposium of Multiparticle Dynamics (ISMD 2011), 26-30, September 2011, Miyajima-Island, Hiroshima, Japan Prog. Theor. Phys. Suppl. **193** (2012) 93-96, arXiv:1204.1125, YITP-12-27.

3. P. Gubler, K. Morita and M. Oka,
"Charmonium spectrum at finite temperature from a Bayesian analysis of QCD sum rules",
Proceedings of Hadron Nuclear Physics 2011, EPJ Web. Conf. **20** (2012) 03001 (7 pages).

4. K. Suzuki, P. Gubler, K. Morita and M. Oka,
"Thermal modification of quarkonium spectral functions from QCD sum rules with the maximum entropy method",
PoS **Confinement X** (2012) 192 (6 pages).

5. Y. Kwon, S. H. Lee, K. Morita and G. Wolf,
"In-medium mass reduction of η'-meson",
PoS **Confinement X** (2012) 193 (6 pages).

Talks at International Conferences

1. "Effect of critical fluctuations on the baryon number probability distribution near chiral phase transition",
6th International Conference on the Exact Renormalization Group (ERG2012), September 3–7, Aussois, France.

2. "Baryon number probability distribution in quark-meson model based on functional renormalization group approach",
The 4th Asian Triangle Heavy Ion Conference (ATHIC 2012), November 14–17 2012, Pusan, Korea.

3. "Modification of hadronic spectral functions under extreme conditions", Invited,
EMMI Rapid Reaction Task Force Kick-Off Meeting, Fluctuations & Correlations & QCD Phase Transitions, February 11–12, 2013, Darmstadt, Germany.

4. "Modeling Probability Distributions Near Chiral Phase Transition", Invited,
EMMI Rapid Reaction Task Force, Probing the Phase Structure of Strongly Interacting Matter with Fluctuations : Theory and Experiment, February 11–22, 2013, Darmstadt, Germany.

5. "Heavy quarkonia at high temperature: What can we learn from QCD sum rules", Invited,
Recent progress in quark-hadron physics, March 16, 2013, Tokyo Institute of Technology, Tokyo, Japan.

6. "Net baryon number probability distributions along the phase boundary", Invited,
Brain-circulation Kick-off Workshop, March 21, 2013, BNL, USA.

Invited Seminars (Overseas)

1. "Baryon number probability distribution in the presence of chiral phase transition", Yonsei University, Korea, May 31, 2012.

Invited Seminars (in Japan)

1. "Baryon number probability distribution in the presence of second order phase transition",
RIKEN Nishina center (Hiyama grp.), Japan, May 7, 2012.

2. “Net baryon number probability distribution near chiral transition”,
RIKEN Nishina center (Hatsuda grp.), Japan, December 17, 2012.

Andrea Prudenziati

Journal Papers

1. A. Prudenziati
“On recursion relations in topological string theory,”
JHEP **1302** (2013) 135 , YITP-12-82, arXiv:1210.4312 [hep-th].

Invited Seminars (Overseas)

1. “Looking for a worldsheet description of the Nekrsov partition function,”
IHEP, Beijing, China, May 2012.

2. “Looking for a worldsheet description of the Nekrsov partition function,”
Capital Normal University, Beijing, China, May 2012.

Invited Seminars (in Japan)

1. “Looking for a worldsheet description of the Nekrsov partition function,”
Kavli IPMU, May 2012.

2. “Looking for a worldsheet description of the Nekrsov partition function,”
Dept. of Phys., Hokkaido University, May 2012.

Jonathan White

Journal Papers

1. J. White, M. Minamitsuji, M. Sasaki
“Curvature perturbation in multi-field inflation with non-minimal coupling,”
JCAP **1207** (2012) 039 (25 pages), YITP-12-37, arXiv:1205.0656 [astro-ph.CO].

Talks at International Conferences

1. “Curvature perturbation in multi-field inflation with non-minimal coupling,”
in “Asia Pacific School/Workshop on Gravitation and Cosmology 2013,” APCTP-NCTS-YITP, Jeju Island, Korea,
February 2013.

2. “Curvature perturbation in multi-field inflation with non-minimal coupling," (poster presentation)
in “Rescue Symposium on General Relativity and Gravitation - JGRG 22," Univ. of Tokyo, Tokyo, Japan,
November 2012.

3. “Curvature perturbation in multi-field inflation with non-minimal coupling," (poster presentation)
in “GCOE Symposium - Development of emergent new fields," Kyoto University, Kyoto, Japan,
February 2013.

Invited Seminars (in Japan)

1. “Curvature perturbation in multi-field inflation with non-minimal coupling,”
RESCEU, Univ. of Tokyo, January 2013.

2.3 Seminars, Colloquia and Lectures

▷ 2012.4.1 — 2013.3.31

4.2 Andrei Marshakov (ITEP, Moscow, Russia) : Clusters, dimers and integrable systems

4.10 Eunkyung Koh (KIAS) : Super Conformal Index on S1 x S3 with Line Operator and Duality Domain Wall

4.11 Igor Shenderovich (IPhT, CEA/Saclay) : Konishi operator in the AdS/CFT correspondence

4.11 Ryousuke Yoshii (YITP) : Transport property in mesoscopic systems

4.12 Donald Ellison (North Carolina State University) : GCOE/YITP seminar:The Surprising Story of Collisionless Shocks in Astrophysics

4.12 Christian Fronsdal (UCLA) : Equations of state for dark matter in General Relativity

4.12 Adam Christopherson (University of Nottingham) : Effects of Non-Adiabatic Cosmological Perturbations

4.16 Christopher Mudry (Paul Scherrer Institut, Switzerland) : The route to fractional topological insulators in two and three dimensions

4.16 Naoki Yamamoto (YITP, Kyoto Univ.) : Holography and anomaly matching for resonances

4.18 Nakwoo Kim (Kyung Hee University) : Quiver matrix models and geometry of Sasaki-Einstein manifolds

4.18 Sosuke Ito (The Univ. of Tokyo) : The relation between information and lower bound to a temperature of a Brownian particle

4.19 Takeru Suzuki (Nagoya Univ.) : MHD turbulence in Keplerian rotating accretion disks

4.25 Hirotaka Irie (YITP) : Stokes phenomena and quantum integrability in non-critical string/M theory

4.25 Kazunari Hashimoto (Osaka Prefecture Univ.) : Complex Eigenvalue Problem of Liouvillian for 1D Quantum Lorentz Gas

4.26 Donald Ellison (North Carolina State University) : GCOE/YITP Seminar:Particle Acceleration in Relativistic Shocks

5.1 Joseph Elliston (Queen Mary, University of London) : Large non-Gaussianity from two-field inflation

5.9 Susanne Reffert (CERN) : 2d Gauge/Bethe correspondence from String Theory

5.9 Ayumu Sugita (Osaka City Univ.) : From Classical Chaos to Quantum Chaos

5.10 Domenico Orlando (CERN) : The Omega Deformation from String and M-Theory

5.11 Satoshi X. Nakamura (YITP, Kyoto Univ.) : Extracting physics from data with dynamical coupled-channels model

5.15 Yoshitsugu Oono (University of Illinois at Urbana-Champaign, USA) : Relation between phenomenology and its microscopic counterpart

5.15 Chihiro Sasaki (Goethe University Frankfurt) : Baryons at high density and the role of the dilaton

5.16 Koshiro Suzuki (Canon Inc.) : Nonequilibrium mode-coupling theory for uniformly sheared systems

5.18 Kazuya Yonekura (YITP, Kyoto Univ.) : Trace anomaly and the anomaly puzzle in SUSY theories

5.22 Tetsuo Hatsuda (RIKEN) : Hadron interactions from lattice QCD

5.22-23 Tetsuo Hatsuda (RIKEN) : Lecture series: QCD Phase Structure at Finite Temperature and Density

5.23 Christian Fronsdal (UCLA) : Entropy in Eulerian Thermodynamics

5.28 Laurent Freidel (Perimeter Institute / YITP) : YITP Colloquium:Recent developments in quantum gravity

5.29 Seyed Akbar Jafari (Sharif Univ. of Technology) : Effect of electronic correlation on massive Dirac fermions in graphene

6.1 Koji TSUMURA (Nagoya University) : Leptophilic two Higgs doublet model at the LHC

6.7 Raphael Bousso (UC Berkeley) : YITP Colloquium:The Cosmological Constant Problem and the Landscape of String Theory

6.8 Shin Nakamura (Kyoto Univ.) : Nonequilibrium Phase Transitions and Nonequilibrium Critical Point from AdS/CFT

6.11 Tatsuro Yuge (Osaka Univ.) : Geometrical Pump for Fermion Transport

6.13 Pierre Descouvemont (Universit*é* Libre de Bruxelles) : Scattering of exotic nuclei

6.20 Yusuke Maeda (The Hakubi center, Kyoto Univ.) : Exploring how large molecules move in a solute gradient

6.22 Masazumi Honda (SOKENDAI, KEK) : Numerical studies of the ABJM theory for arbitrary N at arbitrary coupling constant

6.27 Yoshihisa Harada (ISSP, University of Tokyo) : New trends in resonant soft X-ray emission spectroscopy

6.29 Daisuke Yokoyama : (Tokyo Institute of Technology) : N=2 supersymmetric theories on squashed three-sphere and its gravity dual

7.3 Sylvain Ribault (IPhT, CEA Saclay, France) : Seiberg-Witten equations and non-commutative spectral curves in Liouville theory

7.6 Masahiro Ibe (Institute for Cosmic Ray Research, University of Tokyo) : The Lightest Higgs Boson Mass in the MSSM with Strongly Interacting Spectators

7.9 Tadashi Takayanagi (YITP, Kyoto Univ.) : YITP Colloquium:String Theory and Quantum Entanglement

7.10 Noburo Shiba (Graduate School of Science, Osaka Univ.) : Entanglement entropy of two spheres

7.12 Roberto Gobbetti (New York University, USA) : Cosmic Bubble Collisions

7.18 Avraham Gal (Racah Institute of Physics, The Hebrew University) : Discovery and Significance of Lambda-6H

7.19-20 Kunihito Ioka (KEK) : Lecture Series: High Energy Astrophysics

7.24 Hiroaki Ueda (Tokyo Metropolitan Univ.) : Topological charge pumping effect due to the parity anomaly on the Surface of Three-Dimensional Topological Insulators

7.24-25 Hideyuki Tagoshi (Osaka Univ.) : Lecture series:Gravitational Wave Data Analysis

7.30 Mahdi Godazgar (University of Cambridge) : Peeling of the Weyl tensor and gravitational radiation in higher dimensions.

7.31 Tatsuhiko Ikeda (Tokyo Univ.) : Sufficient conditions and their verifications for the applicability of the microcanonical ensemble in isolated quantum systems

8.8 Ken Umeno (Graduate School of Informatics, Kyoto University) : Chaos and Computation II

8.22 Chikako Uchiyama (Yamanashi Univ.) : Non-Markovian dynamics in open quantum system

8.24 Shuntaro Mizuno (Universit Paris Diderot, Paris 7) : Influence of heavy modes on perturbations in multiple field inflation

8.28 Rak-Kyeong Seong (Imperial College London) : Brane Tilings and Specular Duality

9.10 Jonathan Shock (Max Planck Institute for physics) : The open string membrane paradigm

9.10 Kei Yamada (Hirosaki University) : General relativistic three-body problem – collinear and triangular solutions–

9.10 Hiroki Okawara (Hirosaki University) : Daily and seasonal variations in quantum interference induced by Chern-Simon gravity

9.26 Atsushi Ikeda (Universite de Montpellier II, France) : An unified study of the glass and the jamming transition

10.3 Yu Watanabe (YITP) : YITP Colloquium:Formulation of Uncertainty Relation between Error and Disturbance in Quantum Measurement by using Quantum Estimation Theory

10.3,10,17 Jaume Garriga (YITP/Universitat de Barcelona) : Lecture Series : False vacuum decay and Lorentz invariance.

10.4 Keiichi Maeda (KAVLI, IPMU) : Non-thermal emission from extragalactic supernovae

10.4 Matthew Lake (RESCEU, Tokyo Univ.) : Cosmic strings with twisted magnetic flux lines and wound-strings in extra dimensions

10.10 Cheng-Hung Chang (Institute of Physics, National Chiao Tung University, Taiwan) : Entropic forces for polymer translocation

10.11 Kiyotomo Ichiki (Nagoya Univ.) : CO component estimation based on the independent component analysis

10.15 Rolf Schilling (Institute of Physics, Johannes Gutenberg University Mainz, Germany) : Glass Transition: from Two to Infinite Dimensions

10.23-24 Hideyuki Umeda (Tokyo Univ.) : Lecture Series: Massive Star Evolution

10.24 Masaki Fujita (IMR, Tohoku Univ.) : Recent study of spin excitation in cuprate high-Tc superconductors done at J-PARC

10.26 Yuko Urakawa (U. of Barcelona) : GCOE/YITP Seminar:Fate of long wavelength fluctuations and initial states of inflationary universe

10.31 Kiyoshi Kanazawa (YITP, Kyoto Univ.) : Heat conduction induced by non-Gaussian athermal fluctuations

11.1 Jenifer Nebreda (YITP, Kyoto Univ.) : Properties of light resonances from two QCD parameters: quark masses and number of colors

11.9 Norihiro Iizuka (YITP, Kyoto Univ.) : Bianchi Attractors

11.14 Takahiro Nemoto (Kyoto Univ.) : Large deviation functions of time-averaged quantities

11.15-16 Takashi Oka (The Univ. of Tokyo) : Lecture Series:Theoretical developments in nonequilibrium electron systems: strongly correlated system and Floquet topological phase transition

11.15-16 Kazuyuki Ogata (RCNP, Osaka Univ.) : Lecture Series: Recent development in eikonal reaction studies

11.16 Piljin Yi (KIAS (Korea Institute for Advanced Study)) : Wall-Crossing and Quiver Invariant

11.20 Hajime Sotani (YITP, Kyoto Univ.) : QPOs from giant flares and equation of state for neutron star matter

11.21-22 Kunimasa Miyazaki (Univ. of Tsukuba) : Lecture Series: The Glass Transition and Related Topics

11.30 Nariaki Matsumiya (University of Tokyo) : 5D SYM and 2D q-Deformed YM

12.5 Keisuke Fujii (Osaka Univ.) : Topological quantum computation and its applications

12.7 Rene Meyer (Kavli IPMU) : Holographic Models of the (Fractional) Quantum Hall Effect

12.7 Peter Prelovsek (J. Stefan Institute, Faculty of Mathematics and Physics, University of Ljubljana) : Nonequilibrium properties of Mott-Hubbard insulators

12.7 Matthias Fuchs (University of Konstanz) : On the nonlinear mechanical response of colloidal glass

12.14 Rezso G. Lovas (ATOMKI, Hungary) : Virtual states in nuclear potential problems

12.14 Kazumi Okuyama (Shinshu University) : Instanton Effects in ABJM Theory from Fermi Gas Approach

12.18 Albion Lawrence (Brandeis University) : Informal Seminar: Holographic interpretations of the renormalization group

12.19 Kei-ichi Maeda (Waseda Univ.) : YITP Colloquium:Gravitational Theory: Einstein and beyond

12.19-20 Kei-ichi Maeda (Waseda Univ.) : Lecture Series: Gravitational theories and their cosmological implications

12.20 Kazutoshi Ohta (Meiji Gakuin University) : Non-Abelian Localization for Supersymmetric Yang-Mills-Chern-Simons Theories on Seifert Manifold

12.20 Takahiro Sagawa (The Hakubi Center/YITP) : How to Reconcile Maxwell's Demon with the Second Law?

1.7 Yasuyuki Kato (Los Alamos National Laboratory) : Spin-1 antiferromagnets with single-ion anisotropy

1.8 Dirk Manske (Max-Planck Institute for Solid State Physics, Germany) : Novel Josephson effect in triplet Josephson junctions: the story begins

1.9 Koshiro Suzuki (Canon Inc.) : Recent progress in mode-coupling theory for uniformly sheared underdamped systems

1.9 Hajime Yoshino (Osaka Univ.) : Rigidity of jamming systems at finite temperatures

1.10 Hans-Josef. Schulze (YITP / INFN Catani) : YITP Colloquium:Strange Neutron Stars

1.11 Takahiro Tanaka (YITP, Kyoto Univ.) : IR effect on the prediction of inflation

1.17 Carlos A.R. Herdeiro (Departamento de Fisica da Universidade de Aveiro (Portugal)) : Black hole and shock wave collisions: higher dimensions, charge and different asymptotics

1.18 Simeon Hellerman (Kavli IPMU) : Chern-Simons-matter theory and its holographic dual

1.25 Masahiro Hotta (Tohoku University) : Local Cooling Problem and Quantum Energy Teleportation in Quantum Field Theory

1.25 Antonio Degasperis (Department of Physics, Sapienza, University of Rome, Italy) : Integrable nonlinear wave equations, nonlocal interaction and spectral methods

1.31 Dirk Manske (Max-Planck Institute for Solid State Physics, Germany) : Density-matrix theory for time-resolved dynamics of superconductors in non-equilibrium

2.4 Katsuhiro Nakamura (National University of Uzbekistan) : GCOE/YITP Seminar:Nonequilibrium Equation of States for a Confined Quantum Gas: Effects due to a Moving Piston

2.5 George Jackeli (Max-Planck Institute for Solid State Research in Stuttgart) : Spin-Orbit Coupling in Mott Insulators: Unusual Interactions and Possible Exotic Phases

2.6 Yuki Izumida (Ochanomizu Univ.) : GCOE/YITP Seminar:Nonequilibrium thermodynamics theory describing heat engines working at maximum power

2.15 Chaiho Rim (Sogang University) : GCOE/YITP Seminar:Matrix models for irregular conformal blocks

2.25 Kuniyasu Saitoh (University of Twente, the Netherlands) : GCOE/YITP Seminar:Dynamic Heterogeneity in Floating Grains

2.26 Yasuhiro Asano (Department of Applied Physics, Hokkaido University) : Majorana Fermions and Odd-frequency Cooper Pairs

2.27-28 Naoki Kawashima (ISSP, The Univ. of Tokyo) : Lecture Series:Quantum Monte Carlo Method and Its Applications

2.28 Naoki Tsukamoto (Rikkyo Univ.) : Gravitational lenses in the strong field limit

3.1 Sungmoon Ko (Sogang University) : Superconformal Yang-Mills quantum mechanics and Calogero model with OSp(N|2,R) symmetry

3.1 Yoonji Suh (Sogang University) : Stringy Unification of Type IIA and IIB Supergravities under N=2 D=10 Supersymmetric Double Field Theory

3.1 Dirk Manske (Yukawa Institute for Theoretical Physics/Max Planck Institute for Solid State Research, Stuttgart) : YITP Colloquium:The pairing mechanism in high-temperature superconductors: a long story with a happy end?

3.4 Sosuke Ito (Tokyo Univ.) : Information thermodynamics on network

3.6 Takeshi Kawasaki (Kyoto Univ.) : Hierarchical heterogeneous dynamics in a supercooled liquid: configuration rearrangements and vibration modes

3.8 Masaki Ando (NAOJ) : GCOE/YITP Seminar:New Astronomy by Gravitational waves

3.12 Taichiro Kugo (YITP) : Last lecture: Ambitious to be a Theoretical Particle Physicist

3.12 Ryu Sasaki (YITP) : Last lecture: Pursuit of Unified Structures

3.13 Bernd Kniehl (Hamburg U.) : Heavy-quarkonium theory in the LHC era

3.14 Rafael Lang (Purdue University, USA) : The Direct Search for Dark Matter

3.14 Hiroaki Matsueda (Sendai National College of Technology) : GCOE/YITP Seminar:Information-Geometrical Analysis of Quantum-Classical Correspondence

3.21 Bongsoo Kim (Changwon National University) : GCOE/YITP Seminar:The equilibrium dynamics of the Dean-Kawasaki model for colloids: the standard MCT and beyond

3.22 Masaki Murata (Institute of Physics AS CR) : Relationship between Marginal Deformation Parameters in Boundary CFT and Cubic SFT

2.4 Visitors (2012)

Atom-type Visitors

Sato, Matsuo (E)
Hirosaki University
2012.02.29 – 2012.4.8

Visitors

de Forcrand, Philippe (N)
ETH
2012.3.28 – 2012.4.9

Ellison, Donald (A)
North Carolina State University
2012.4.1 – 2012.4.30

Christopherson, Adam J. (A)
University of Nottingham
2012.4.4 – 2012.4.15

Shenderovich, Igor (E)
Institut de Physique Theorique, CEA.Saclay
2012.4.8 – 2012.4.14

Hatsuda, Yasuyuki (E)
TIT
2012.4.9 – 2012.4.13

Fronsdal, Christian (E)
UCLA
2012.4.10 – 2012.5.31

Zlatic, Veljko (C)
Institut of Physics, Croatia
2012.4.15 – 2012.4.18

Elliston, Joseph (A)
Queen Mary University of London
2012.4.26 – 2012.5.3

Kim, Soo A (A)
Asia Pacific Centre for Theoretical Physics
2012.4.29 – 2012.5.4

Orlando, Domenico (E)
CERN
2012.5.8 – 2012.5.11

Reffert, Susanne (E)
CERN
2012.5.8 – 2012.5.11

Suzumura, Yoshikazu (C)
Nagoya University
2012.5.9 – 2012.5.10

Eguchi, Tohru (E)
Rikkyo University
2012.5.10 – 2012.5.11

Hikami, Kazuhiro (E)
Kyushu University
2012.5.10 – 2012.5.11

Yamauchi, Daisuke (A)
University of Tokyo
2012.5.14 – 2012.5.16

Matsueda, Hiroaki (C)
Sendai National College of Technology
2012.5.17 – 2012.5.19

Hatsuda, Tetsuo (N)
RIKEN
2012.5.21 – 2012.5.23

Jafari, Seyed Akbar (C)
Sharif Univ. of Tech.
2012.5.24 – 2012.8.21

Kun, Ferenc (C)
Univ. of Debrecen
2012.5.31 – 2012.6.1

Pi, Shi (A)
Peking University
2012.6.3 – 2012.6.10

Bousso, Raphael (A)
UC Berkeley
2012.6.7 – 2012.6.8

Descouvemont, Pierre (N)
Universite Libre de Bruxelles
2012.6.8 – 2012.6.22

Ohkubo, Shigeo (N)
Kochi Women's University
2012.6.13 – 2012.6.15

Ho, Choon-Lin (E)
Tamkang Univ.
2012.6.14 – 2012.9.13

Suzuki, Yasuyuki (N)
Niigata University
2012.6.14 – 2012.7.14

Kohri, Kazunori (A)
KEK
2012.6.15 – 2012.6.16

Tom Devereaux (C)
SLAC National Accelerator Laboratory, Stanford University
2012.6.15 – 2012.6.28

Horiuchi, Wataru (N)
Hokkaido University
2012.6.17 – 2012.6.20

Aoyama, Shigeyoshi (N)
Niigata University
2012.6.19 – 2012.6.21

Gobbetti, Roberto (A)
New York Univ.
2012.6.30 – 2012.8.4

Nishimura, Nobuya (A)
University of Basel
2012.7.2 – 2012.7.13

Ribault, Sylvain (E)
CEA Saclay, France.CNRS
2012.7.2 – 2012.7.10

Koshibae, Wataru (E)
RIKEN
2012.7.6 – 2012.7.6

Gal, Avraham (N)
The Hebrew Univ. of Jerusalem
2012.7.15 – 2012.7.19

Dorey, Patrick E. (E)
Durham University
2012.7.16 – 2012.7.18

Ioka, Kunihito (A)
KEK
2012.7.18 – 2012.7.20

Matsueda, Hiroaki (C)
Sendai National College of Technology
2012.7.22 – 2012.7.23

de Rham, Claudia (A)
Case Western Reserve Univ.
2012.7.23 – 2012.8.8

Tolley, Andrew J. (A)
Case Western Reserve Univ.
2012.7.23 – 2012.8.8

Tagoshi, Hideyuki (A)
Osaka University
2012.7.24 – 2012.7.26

Eguchi, Tohru (E)
Rikkyo University
2012.8.6 – 2012.8.10

Naruko, Atsushi (A)
APC, Univ. of Paris 7
2012.8.8 – 2012.8.17

Kanno, Sugumi (A)
Tufts University
2012.8.14 – 2012.9.23

Moritani, Yuuki (A)
Hiroshima University
2012.8.22 – 2012.8.24

Okazaki, Atsuo (E)
Hokkai-Gakuen University
2012.8.22 – 2012.8.24

Seong, Rak-Kyeong (A)
Imperial College London
2012.8.25 – 2012.8.29

Sago, Norichika (E)
Kyushu University
2012.9.6 – 2012.9.10

Shock, Jonathan (A)
Max Planck Institute for Physics
2012.9.9 – 2012.9.12

Hayasaki, Kimitake (E)
Korea Astronomy and Space Science Institute
2012.9.15 – 2012.9.17

Kawachi, Akiko (A)
Tokai University
2012.9.15 – 2012.9.17

Michihiko Yamamoto (A)
Tokai University
2012.9.15 – 2012.9.17

Mori, Masaki (A)
Ritsumei University
2012.9.15 – 2012.9.17

Naitoh, Tsuguya (A)
Yamanashi Gakuin University
2012.9.15 – 2012.9.17

Okazaki, Atsuo (A)
Hokkai-Gakuen University
2012.9.15 – 2012.9.17

Takata, Jumpei (A)
The University of Hong Kong
2012.9.15 – 2012.9.17

Yamaguchi, Masaki (A)
Osaka University
2012.9.15 – 2012.9.17

Zhao, Peng (E)
University of Cambridge
2012.9.17 – 2012.11.10

Odake, Satoru (E)
Shinshu University
2012.9.18 – 2012.9.21

Pi, Shi (A)
Peking University
2012.9.24 – 2012.12.16

Maruhn, Joachim (N)
Universitat Frankfurt
2012.9.29 – 2012.10.7

Hanawa, Tomoyuki (A)
Chiba University
2012.10.1 – 2012.10.28

Nebreda Manjon, Jenifer (N)
Univ. of Bonn
2012.10.1 – 2013.9.30

Michel, Nicolas (N)
Univ. of Tennessee
2012.10.8 – 2012.10.14

Umeda, Hideyuki (A)
Univ. of Tokyo
2012.10.22 – 2012.10.24

Urakawa, Yuko (A)
University of Barcelona
2012.10.22 – 2012.11.2

Kruppa, Andras Tibor (N)
ATOMKI
2012.10.26 – 2012.10.30

Levai, Geza (N)
ATOMKI
2012.10.26 – 2012.10.30

Kun, Ferenc (C)
Univ. of Debrecen
2012.11.1 – 2012.11.2

He, Haoning (A)
Purple Mountain Observatory
2012.11.2 – 2013.1.29

Maeda, Kei-ichi (A)
Waseda University
2012.11.2 – 2012.12.27

Park, Jung Jun (C)
Pusan National University
2012.11.2 – 2012.11.7

Bonca, Janez (C)
Ljubljana University
2012.11.13 – 2012.11.16

Oka, Takashi (C)
University of Tokyo
2012.11.13 – 2012.11.16

Ogata, Kazuyuki (N)
Osaka University
2012.11.14 – 2012.11.16

Yi Piljin (E)
KIAS
2012.11.14 – 2012.11.18

Miyazaki, Kunimasa (C)
Tsukuba University
2012.11.21 – 2012.11.22

Mueller, Berndt (N)
Duke University
2012.12.1 – 2012.12.8

Odake, Satoru (E)
Shinshu University
2012.12.2 – 2012.12.6

Prelovsek, Peter (C)
Jozef Stefan Institute
2012.12.2 – 2012.12.8

Wan, Mew-Bing (A)
APCTP
2012.12.3 – 2013.3.2

Muller, Peter (N)
Los Alamos National Laboratory
2012.12.9 – 2012.12.21

Li, Jinping (C)
Harbin Institute of Technology
2013.1.1 – 2013.12.31

Romano, Antonio Enea (A)
University of Antioquia
2013.1.11 – 2013.2.15

Matsueda, Hiroaki (C)
Sendai National College of Technology
2013.1.18 – 2013.1.20

Degasperis, Antonio (E)
University of Rome, La Sapienza
2013.1.22 – 2013.2.22

Odake, Satoru (E)
Shinshu University
2013.1.25 – 2013.1.28

Gong, Jinn-Ouk (A)
APCTP
2013.1.27 – 2013.2.2

Nakaramura, Katsuhiro (C)
National University of Uzbekestan
2013.2.4 – 2013.2.5

Izumida, Yuki (C)
Ochanomizu Universit
2013.2.6 – 2013.2.7

Ohkubo, Shigeo (N)
University of Kouchi
2013.2.7 – 2013.2.28

Vallisneri, Michele (A)
Jet Propulsion Lab., CALTECH
2013.2.7 – 2013.2.14

Saitoh, Kuniyasu (C)
Universiteit Twente
2013.2.9 – 2013.3.10

Tanaka, Masaomi (A)
NAOJ
2013.2.12 – 2013.2.13

Eguchi, Tohru (E)
Rikkyo University
2013.2.14 – 2013.2.16

Hikami, Kazuhiro (E)
Kyushu University
2013.2.14 – 2013.2.16

Rim, Chaiho (E)
Chonbuk National Univ.
2013.2.15 – 2013.2.26

Bucher, Martin (A)
Univ. of Paris 7
2013.2.15 – 2013.2.18

Bucher, Martin (A)
Univ. of Paris 7
2013.2.23 – 2013.3.3

Hayasaki, Kimitake (A)
Korea Astronomy and Space Science Institute
2013.2.24 – 2013.2.28

Sago, Norichika (A)
Kyushu University
2013.2.25 – 2013.2.28

Ko, Sung moon (C)
Chonbuk National Univ.
2013.2.26 – 2013.3.4

Suh, Yoonji (E)
Chonbuk National Univ.
2013.2.26 – 2013.3.4

Kawashima, Naoki (E)
University of Tokyo
2013.2.26 – 2013.2.28

Mizuta, Akira (A)
KEK
2013.2.27 – 2013.2.28

Moro Munoz, Antonio M. (N)
University of Seville
2013.3.4 – 2013.3.22

Ando, Masaki (A)
NAOJ
2013.3.8 – 2013.3.9

Matsueda, Hiroaki (C)
Sendai National College of Technology
2013.3.12 – 2013.3.15

Murata, Masaki (E)
Institute of Physics AS CR
2013.3.12 – 2013.3.15

Ogawa, Noriaki (E)
KIAS
2013.3.12 – 2013.3.15

Kaneshita, Eiji (C)
Sendai National College of Technology
2013.3.13 – 2013.3.15

Kniehl, Bernd (E)
Hamburg University
2013.3.13 – 2013.3.15

Lang, Rafael (E)
Purdue University
2013.3.13 – 2013.3.15

Uchiyama, Chikako (C)
Yamanashi Univ.
2013.3.19 – 2013.3.19

Kim, Bongsoo (C)
Changwon National University
2013.3.20 – 2013.3.23

Higuchi, Atsushi (A)
University of York
2013.3.21 – 2013.3.21

In the above lists, the symbols A, C, E and N in the parentheses are thefollowing abbreviations of research fields:

A: Astrophysics and Cosmology
C: Condensed Matter and Statistical Physics
E: Elementary Particle Theory
N: Nuclear Physics Theory

Chapter 3

Workshops and Conferences

3.1 International Workshops and Conferences

Since 1978, a series of international physics workshops, called *Yukawa International Seminar (YKIS)* are held annually or bi-annually. *The Nishinomiya Yukawa Memorial Project* was initiated by Nishinomiya city where the late Prof. Hideki Yukawa lived when he wrote his famous papers on the meson theory. As one of the major programs of this project, an international symposium open to public was held every year in Nishinomiya city, and its post/pre-workshop held at YITP. In recent years both the Nishinomiya Yukawa Symposium and its post/pre-workshops are held at YITP, Kyoto.

As of the academic year 2007, Yukawa Institute for Theoretical Physics launched a new five-year project, "*Yukawa International Program for Quark-Hadron Sciences* (YIPQS)." A few research topics are selected each year and a long-term workshop focused on each topic, extending over a period of a few months, is organized by inviting leading experts from the world. Emphasis is laid on fostering fruitful collaboration among the workshop participants.

In addition to these regular annual conferences, many international workshops and conferences of various sizes and durations from several days to more than one month are held every year.

Here is a list of main international workshops and conferences held in the academic year 2011.

Yukawa International Seminar (YKIS2012)

YKIS2012 : From Gravity to Strong Coupling Physics
Oct 15 - Oct 19, 2012, Chaired by Taichiro Kugo 124 participants (53 from abroad)
For details, see http://www2.yukawa.kyoto-u.ac.jp/ ykis2012/index.html

Nishinomiya-Yukawa Symposium 2012

Nishinomiya Yukawa Symposium on New Waves in Gravity and Cosmology
Dec 4 - Dec 6, 2012, Chaired by Takahiro Tanaka, 147 participants (58 from abroad)
For details, see http://www2.yukawa.kyoto-u.ac.jp/ws/2012/gc2012/symposium/index.html

3.2 YITP Workshops

YITP workshops are one of the main activities of Yukawa Institute. The aim of them is to open new research fields and stimulate nationwide collaborations. Workshop plans can be proposed by any researcher and are approved by the Committee on Research Projects of the Institute. Small workshops, summer schools and regional schools to educate young researchers are positively supported.
In the past 5 years, more than 20 workshops are held each year with 1500 strong participants visiting YITP. The list of the workshops together with the number of participants for the last academic year is given below.

▷ 2012.4.1 — 2013.3.31

Here is the list of workshops with the dates, the names of organizers, the number of participants, the proceedings and the url's.

YITP-W-12-01
FIRST STARS IV : From Hayashi to the future, May 20-25, 2012. T. Hosokawa, M. Mori, T. Okamoto, K. Omukai, H. Susa, Y. Suwa, A. Tanikawa, N. Tominaga, *130-participants,*

YITP-W-12-02
The XXV International Conference on Neutrino Physics and Astrophysics, Jun 3-9,2012. S. Aoki, A. K. Ichikawa, H. Kawai, T. Kishimoto, T. Kobayashi,M. Kuze, T. Maruyama, A. Minamino, T. Mori, M. Nakahata, M. Nakamura, T. Nakaya, N. Sasao, T. Tanaka, T. Tanimori, K. Yamamoto, O. Yasuda, M. Yokoyama, S. Yoshida, *612-participants,* http://neu2012.kek.jp/index.html

YITP-W-12-03
Physics of Iron-Based Superconductors: Spin, Orbital, and Lattice, Jun 21-22, 2012. T. Tohyama, K. Kuroki, R. Arita, H. Kontani, H. Ikeda, Y. Matsuda, *59-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/fesuper/

YITP-W-12-04
Progress in Particle Physics 2012, Jul 18-21, 2012. M. IBE, K. ODA, R. KITANO, F. TAKAYAMA, K. TOBE, K. HAMAGUCHI, H. FUKAYA, S. MATSUMOTO, K. YOSHIOKA, *115-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/ppp2012/

YITP-W-12-05
Field Theory and String Theory, Jul 23-27, 2013. T. Azeyanagi, Y. Okawa, M. Kato, H. Kunitomo, T. Sakai, M. Sakamoto, S. Sugimoto, T. Takayanagi, Y. Tachikawa, K. Hashimoto, M. Hamanaka, K. Hosomichi, K. Yoshida, *173-participants,* http://www2.yukawa.kyoto-u.ac.jp/q̃ft/

YITP-W-12-06
summer school 'From quark to supernovae, Jul 27-31, 2012. S. Aoki, T. Hatsuda, E. Hiyama, A. Ohnishi, M. Shibata, T. Ichikawa, *66-participants,* http://bridge.kek.jp/

YITP-W-12-07
Physics of Nonequilibrium Systems - Toward the Understanding of its Universal Aspects-, Aug 1-4, 2012. M. Ichikawa, K. Saito, T. Sagawa, T. Sasamoto, K. Takeuchi, H. Hayakawa, *147-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/noneq12/

YITP-W-12-08
Summer School on Astronomy and Astrophysics 2012, Aug 1-4, 2012. K. Hiroi, S. Ryu, K. Nakamura, J. Okumura, A. Kataoka, S. Isoyama, T. Yoshikawa, T. Tamura, T. Ohnishi, Y. Korai, M. Shidatsu, *410-participants,* http://astro-wakate.sakura.ne.jp/ss2012/web/index.html

YITP-W-12-09
Young Nuclear and Particle Physist Group of Japan, Aug 2-7, 2012. Y. Kikuta, S. Okazawa, K. Takayama, Y. Arita, H. Hoshino, N. Shirai, S. Kamoshita, K. Ohtani, A. Oikawa, T. Kojita, Suganuma, Y. Asano, Y. Morita, H. Takano, H. Suzuki, Y. Fukuoka, S. Takahashi, *300-participants,*

http://hken.phys.nagoya-u.ac.jp/šs2012/

YITP-W-12-10
The 57th Condensed Matter Physics Summer School, Aug 6-10, 2012. H. Kawasoko, K. Akiyama, M. Kawamura, Y. Nishitani, R. Ishiyama, Y. Onishi, S. Kondo, K. Katayama, T. Nakao, R. Higa, T. Igarashi, M. Miyara, T. Hinokihara, H. Fujii, *205-participants,* https://cmpss.jp/

YITP-W-12-11
52nd summer school of young researchers society for biophysics, Aug 31 - Sep 3, 2012. K. Shibasaki, *69-participants,*

YITP-W-12-12
Thermal Quantum Field Theory and Their Applications, Aug 22-24, 2012. A. ASAKAWA, S. ABE, K. IIDA, T. INAGAKI, S. EJIRI, A. OHNISHI, M. OKUMURA, M. Kitazawa, M. SAKAGAMI, M. TACHIBANA, C. NONAKA, M. MINE, S. MUROYA, *100-participants,* http://www.riise.hiroshima-u.ac.jp/TQFT/

YITP-W-12-13
Various phases and equation of state of hadronic matter — in light of neutron-star observations, Aug 30 - Sep 1, 2012. T. Muto, T. Tatsumi, T. Maruyama, T. Takatsuka, M. Tachibanak, T. Noda, K. Iida, A. Ohnishi, Y. Sekiguchi, K. Oyamatsu, K. Sumiyoshi, S. Yamada, M. Takano, K. Nakazato, H. Sotani, *83-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/stareos/nseos/nseos2012.html

YITP-W-12-14
Nuclear Energy crossover Biology and Physics, Aug 8-10, 2012. , *147-participants,*

YITP-W-12-15
East Asia Numerical Astrophysics Meeting, 5th, Oct 29 - Nov 2, 2012. Liang Gao, Pin-Gao Gu, T. Hanawa, Jongsoo Kim, E. Kokubo, Yipeng Jing, Fukun Liu, J. Makino, Dongsu Ryu, M. Shibata, Ronald Taam,N. Yoshida, *93-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/eanam5/

YITP-W-12-16
Physics of Quantum Spin Systems, Nov 12- 14, 2012. H. Ohta, M. Oshikawa, H. Kawamura, T. Sakai, M. Takigawa, H. Tanaka, S. Todo, K. Totsuka, H. Nojiri, M. Hagiwara, *159-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/qss2012/

YITP-W-12-17
Self-organization and Emergent Dynamics in Active Soft Matter, Feb 18- 20, 2013. M. Sano, M. Imai, H. Hayakawa, T. Araki, D. Mizuno, M. Ichikawa, H. Kitahata, M. Iima, H. Wada, *163-participants,* http://softmatt-net.xsrv.jp/20130218/index.html

YITP-W-12-18
Friction, Rheology and Earthquake - Across the Hierarchy and the Stage-, Nov 6-8, 2012. H. Kawamura, H. Hayakawa, T. Yamaguchi, T. Hatano, K. Miura, M. Suzuki, N. Sasaki, M. Otsuki, H. Matsukawa, *83-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/friction/

YITP-W-12-19
Resonances and non-Hermitian systems in quantum mechanics, Dec 11-13, 2012. K. Kato, I. Shimamura, N. Hatano, A. Hosaka, D. Jido, *50-participants,* http://www2.yukawa.kyoto-u.ac.jp/ws/2012/NonHermite/Top.html

YITP-W-12-20
Microscopic effective interactions and studies of structures and reactions of nuclei, Feb 12-14, 2013. M. Kohno, H. Kamada, K. Takayanagi, W. Horiuchi, T. Abe, M. Yamaguchi, R. Okamoto, *40-participants,*

YITP-W-12-21
LHC vs Beyond the Standard Model –Frontier of particle physics, Mar 19-25, 2013. R. Kitano, F. Takayama, Y. Nakai, M. Ibe, *53-participants,* http://www2.yukawa.kyoto-u.ac.jp/ ynakai/index.html

3.3 Regional Schools supported by YITP

▷ 2012.4.1—2013.3.31

Here is the list of the Regional Schools with the dates, the place, the name(s) of the main invited Lecturer(s) and the participating Universities.

YITP-S-12-01
Hokuriku Spring School 2012, May 15-20, 2012, National Myoko Youth Outdoor Learning Center.
H. Nakano

YITP-S-12-02
Chubu Summer School 2012, Sep 3-6 , 2012, Yamanakako Seminar House, Tokai Univesity.
T. Fujishiro

YITP-S-12-03
17th Niigata-Yamagata joint school, Nov 2-4, 2012, National Bandai Youth Friendship Center.
S. Ejiri

YITP-S-12-04
The 35th Shikoku Seminar on Particle and Nuclear Physics, Dec 15-16, 2012, Kochi University.
K. Ishiguro

YITP-S-12-05
The 25th Hokkaido Nuclear Theory Group Meeting, Feb 20-22, 2013, Hokkaido University.
M. Kimura

YITP-S-12-06
Hokuriku-Shinetsu Winter School, Mar 7-10, 2013, Kenshuu Kouryuukan Hakusanri.
D. Suematsu